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SMOKE SIGNAL BROADCASTING

MNEMONIC ASSEMBLER

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SSB 6800 MNEMONIC ASSEMBLER

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The SSB 6800 Mnemonic Assembler was written for maximum flexibility making it usable to owners of RAM-only systems as well as disk system owners. As always, flexibility adds complexity and therefore the user is advised to read the following application notes thoroughly before trying to use this program. Disk users should read Appendix A.

It is assumed that the user is familiar with assembly language and, in particular, the mnemonics of the M68ØØ assembly language. Those who are not are referred to the "M68ØØ Microprocessor Programming Manual" or the "M68ØØ Programming Reference Manual," both available from your Motorola distributor.

The source language (input) for the SSB 68ØØ Mnemonic Assembler consists of a subset of the 7-bit ASCII (American Standard Code for Information Interchange, 1968) character set. Special meaning is attached to many of these characters as will be described later. In all cases the parity bit (most significant bit) of each character must be Ø. This restriction, of course, does not apply to line numbers, if present.

Each line of source for the assembler consists of any number of bytes (possibly none) preceeding the first character of the source statement, followed by the source statement, followed by a carriage return (hex ØD). The source statement consists of up to four "fields" which are free format. From left to right, the four fields are label , operator (mnemonic),

operand, and comment. There must be at least one space between each of these fields. Further restrictions and options for each of these fields are:

label field

1) The label must begin in the first column and must be unique.
2) Labels consist of letters (A-Z) and numerals (Ø-9).
3) Every label must begin with a letter (A-Z).
4) Only the first 6 characters of any label are significant, the rest are ignored.
5) The label field may be the only field present.

operator field

1) The operator is 3 alphabetic characters (A-Z) which must be followed by a space. The exception to this is number 2, below.
2) Mnemonics such as LDA A and AND B may be written as LDAA and ANDB, respectively. In this case fourth character must be followed by a space.

operand field

1) The operand field may consist of an addressing mode indicator and an expression or just an expression.
2) The addressing mode indicator is either a # (Pound sign) followed by an expression for immediate addression or an expression followed by ,X for indexed addression. (Expressions defined later.)
3) An operand may or may not be required depending on the addressing mode.

comment field

1) The comment field is optional

2) Comments may contain any character from SPACE ($2Ø) to DEL ($7F).

Expressions

Expressions consist of combinations of numbers and symbols seperated by one of the four arithmetic operators +, - , *, /. The arithmetic is done with 16 bit integer operands and truncated as necessary. 8 bit results are taken from the least significant 8 bits. Unary (+) and (-) are allowed. Expressions must not contain spaces.

Numbers

Numbers are groupings of the numerals Ø-9 and possibly letters prefixed or postfixed by a base indicator. Possible base indicators are shown below. The ASCII base allows a single ASCII character ($2Ø-$5F) to be used as an operand when preceeded by a single quote.

Base	Prefix	Postfix	Comment
Decimal	none	none	decimal assumed
Binary	%	B	Ø, 1 allowed
Octal	@	O or Q	Ø-7 allowed
Hexadecimal	$	H	Ø-9, A-F allowed
ASCII	'	not allowed	ASCII equivalence

Symbols

Symbols are groupings of letters and numerals the first 6 of which are significant and the first of which must be a letter. The single character * is a special symbol whose value is the current value of the program counter (PC).

Evaluation of Symbols and Expressions

Since this is a two pass assembler all symbols must be resolved in the two passes. Therefore, only one level of forward referencing is allowed.

Assembler Directives

In addition to the 72 M68ØØ mnemonics this assembler supports 11 assembler directives or pseudo-ops. These pseudo-ops are listed below along with a brief description. More detailed descriptions follow.

FCC	form constant character
FCB	form constant byte
FDB	form double byte
SPC	insert spaces in output listing
OPT	activate or deactivate assembler options
PAG	skip to next page of output
ORG	define new origin (PC)
EQU	assign value to symbol
END, MON	signal end of source program
NAM, TTL	specify name or title
RMB	reserve memory bytes

FCC

The function of FCC is to create character strings for messages or tables. The character string 'text' is broken down to ASCII, one character per byte. The two allowable formats are shown below:

```
label     FCC     count, text
```

or

```
label     FCC     delimiter text same delimiter
```

where count is any legal expression. In the case where a number is used as a delimiter the first character of text must not be a comma. The character limit of any single FCC statement is 255. The use of label is optional.

FCB

The FCB pseudo-op causes an expression to be evaluated and the resultant 8 bits placed in memory. Usage is shown below:

label FCB expression 1, expression 2,...,expression N

Each expression is seperated by a comman with a maximum of 255 expressions per FCB statement. The label is optional.

FDB

The function of the FDB directive is identical to FCB except 16 bit quantities are assembled, i.e., two bytes generated for each expression. The required format is shown below:

label FDB expression 1, expression 2,...,expression N

where the label is optional. The maximum number of expressions is 127.

SPC

The SPC operator causes the specified number of spaces to be inserted in the output listing. The format is shown below.

SPC expression

Notice that no label is allowed. If 'expression' evaluates to zero one space is inserted. The operator SPC itself does not appear in the output listing. If PAGE mode is selected SPC will not cause spacing past the top of the next page.

OPT

The directive OPT is used to activate or deactivate the assembler options. The format is shown below. Notice that no label is allowed and no code is generated.

```
OPT     option 1, option 2,...,option N
```

The allowable options are:

SYM	print sorted symbol table after the listing (default)
NOS	do not print the symbol table
GEN	print all code generated by FCB, FDB, and FCC (default)
NOG	print only one line for each FCB, FDB, or FCC
LIS	print the assembled source listing (default)
NOL	suppress the printing of the source listing
PAG	enable page formatting and numbering
NOP	disable page mode (default)
TAP	enable the production of MIKBUG object tape
NOT	disable the production of MIKBUG object tape (default)

If contradicting options appear the last one appearing takes precedence. All options take effect simultaneously at the beginning of pass 2. The default options specified take effect unless the user specifies a particular option. Only the first 3 characters of an option name are significant and multiple options are seperated by a comma. Some of the consequences and uses of the options will be explained later.

PAG

The PAG operator, if the PAG option is on, causes a page eject and subsequently causes the title (if any) and page number to be printed at the top of the next page. No label is allowed and no code is produced. Notice that the first page of any listing is page Ø and no title is printed on that page. The PAG operator itself will not appear in the listing.

The usual procedure is to have all the options and the title declaration followed by a PAG be the first statements in a program.

ORG

The ORG operator, whose format is shown below, causes a new origin address (PC) for the code following.

```
        ORG     expression
```

No label is allowed and no code is produced. If no ORG appears an origin of ØØØØ is assumed.

EQU

EQU is used to equate a symbol to an expression as shown below. A label is required and no code is generated. Only one level of forward referencing is allowed and the equate must not be recursive.

```
label   EQU     expression
```

No code is produced by EQU.

END or MON

These operators signal the assembler that the end of the source input has occurred. No label is allowed and no code is generated.

NAM or TTL

These operators are used to assign a title to be printed at the top of all pages (other than page Ø) if the PAG option is on. If the PAG option is off this operator has no effect. The format, as shown below allows up to 32 characters in the title. No label is allowed

```
TTL     text for the title
```

and no code is generated. If more than one TTL or NAM operator appears the last one "executed" will be printed on the next page.

RMB

This operator causes the assembler to reserve memory for data storage. No code is produced and therefore the contents of those memory locations are undefined at run time. The label is optional as shown below

```
label     RMB     expression
```

where 'expression' is a 16 bit quantity.

** Description of assembler operation

Pass 1 - PASONE ($03B1)

Pass 1 is used to build the symbol table which is used to resolve forward references. Nothing is printed unless the error limit is exceeded (85). Pass 1 must be run before PASS 2 and again before PASS 3.

Pass 2 - PASTWO ($03D9)

During pass 2 several things may happen.

1) If the LIST option is on, the assembled source listing is printed with error messages, if any.

2) If the LIST option is off only offending source lines and their corresponding error messages are printed.

3) If the TAPE option is on, a MIKBUG formatted object record is outputted (through a different control point than the source listing).

4) If the SYMBOL option is on, a sorted symbol table will be printed after the assembly listing (if any). Pass 1 must be run before PASS 2.

Pass 3 - PASTHR ($05BB)

Pass 3 is used when the user does not have a "punch" device, on which to save the MIKBUG formatted records, which operates independently from the list device. Pass 3 is identical in operation to pass 2 except that NOSYM, NOLIST, and TAPE options are forced and error messages are suppressed. Pass 1 must be run before PASS 3, PASS 2 and PASS 3 are independent.

Initialization

There exists in the assembler an initialization routine for each of the passes which must be run once before that pass in run. These are called P1INIT, P2INIT, and P3INIT for passes 1, 2, and 3, respectively.

Adapting to Your System

Due to the inherent flexibility of this assembler it is necessary that each user customize it to fit the particular system. This involves very few changes and can be made by any individual familiar with 6800 assembly language. Each point to be adapted is explained below.

Output Character Routine

The address at $0321 must be changed to that of your Output Character routine. This routine must print the ASCII character in the A register whose parity bit (most significant bit) is zero. The B and X registers must not be altered. If you have a printer or a disk you will likely want to specify the address of a program which handles these peripherals as well as the control terminal.

Tape Output Character Routine

The address at $0324 must be changed to that of your tape punch (or tape record) routine. It is through this control point that the MIKBUG formatted object code is outputted. If you do not have a seperate punch or record device this address may be the same as the Output Character routine address, i.e., tape device same as list device.

Tape Control Characters

There are provisions at $04C0 and $04C4 for four control characters to activate and deactivate, respectively, your punch or record device. Simply place the appropriate control characters for your device in each of the strings. If you desire to send less than the four characters, change the byte at $04B3 to the appropriate value (even Ø). This will, of course, affect both turn on and turn off simultaneously.

Tape Control Delay

The byte at $04C9 controls the number of half-seconds (1MHz clock) of delay between tape turn on and data and also between data and tape turn off. The delay is set now to 2 seconds. If you don't need delay at all set the byte to ØØ.

Page Control

Page Eject

The four bytes at $11D1 are provided for the user to insert the necessary control characters to cause the printer to form feed, i.e., eject to the top of the next page. If you need only 1 character, simply place the Ø4 after that character in the string. The control character is currently set to $ØA (line feed).

Top Margin Control

The byte at $1143 controls the number of lines from the form feed position to the title and page number line (can be Ø).

Page Length Control

The byte at $07C5 controls the number of lines to be printed on each page before the form feed is issued. This count includes the top margin and the title line and should be larger than (top margin + 1).

The user may want to alter other features such as the number of columns printed in the symbol table, etc. Most modifications of this type will be needed by only a few users and therefore will not be elaborated upon here. These users are encouraged to study the code to facilitate making the desired modifications.

Controller Routine

Disk users should not be concerned with this section but instead turn to Appendix A.

The routine MAIN ($300) is an example of how to use the assembler subroutines. The assembler can be run by simply starting execution at the program of MAIN after setting up the appropriate pointers as described below. It assumes the user has no independent punch or tape recording device and therefore must run PASS 3 in order to output the object code. If an independent punch device is available, PASS 3 may be eliminated and OPT TAP may be used. Also, MAIN assumes the source program resides entirely in RAM and that the necessary pointers are set.

If rewriting the MAIN routine, or providing your own, be reminded that PASS 1 needs to be run before PASS 2 and again before PASS 3. Also remember to run the pass initiatization routines.

One note of caution: the END operator is not strictly necessary at the end of a program as the pass in effect will terminate at the end of the source area. However, if you are generating object code, only an END statement will flush the code buffer or fix the memory count. Likewise, only an END operator will cause the symbol table to be printed (if SYM is on). The byte ENDFLG ($0058) will be set ($FF) if the END operator occurs, which can be detected by your MAIN routine.

Assembler Data Pointers

Before calling any assembler routines the user must set several pointers to data areas. This feature allows much flexibility but restrictions which apply to each pointer are outlined below. No assembler routines modify these pointers.

LBLBEG - $ØØ4Ø

LBLEND - $ØØ42

These are the pointers to the area which will be used for the label table (symbol table). Each entry (symbol) in the table requires 8 bytes. A large table will result in the Put Label and Find Label routines running faster but the Shell (sort) routine will run slower. A small table will have the opposite effect. Of course, the table needs to be large enough to accomodate the number of symbols in your program. A reasonable formula for determining the size necessary is:

SIZE = N * 8 * 2 = N * 16 bytes

where N is an estimate of the number of symbols expected. When the table is full an error message will be inserted in the listing. (The table may not be completely full due to the algorithm used for creating the table - hashing, or scatter storage.)

If you want a 1K symbol table (a recommended minimum, enough for 60-80 labels) you might set LBLBEG to $2ØØØ and LBLEND to $23FF. Notice that the pointers do point to the actual beginning and end of the table.

SRCBEG - $ØØ44

SRCEND - $ØØ46

These two pointers indicate the beginning and end of the section of source code to be assembled, which may be as small as one line of source. SRCEND must point to the carriage return ($ØD) of the last line of the source section to be assembled.

LINBYT - $ØØ48

Although not actually a pointer LINBYT is related to the source pointers. It tells the assembler how many bytes to ignore from carriage return of the previous line (or SRCBEG) before actually processing text. This allows direct output of text editors to be assembled without removing the preceeding line numbers. If you have no line number bytes, set LINBYT to Ø.

MEMPTR - $ØØ49

This pointer tells the assembler where in memory, if the MEMORY option is on, to put the assembled object code. Recall that four extra bytes (address and count) are required for each contiguous block of code.

Error Messages

This assembler supports 12 error messages which are printed after the offending line. The error messages announce violations of any of the restrictions set forth in this manual and are, therefore, self-explanatory.

Additionally, the byte 'ERRORS' (cleared by PIINIT) will be set if any errors have occurred in any of the passes.

Note: The ASCII characters ØØ - $ØC, $ØE - $1F, and $8Ø - $8F, inclusively are explicitly prohibited from being in any area of the source program with the exception of the bytes which are skipped by the assembler (line number bytes). Their existence will cause undefined results. The remaining ASCII characters may appear subject to all of the foregoing restrictions.

Additional Feature

This assembler supports 2 extra mnemonics namely BHS and BLO which are the logical equivalents of BCC and BCS respectively. However, Branch if Higher or Same and Branch if Lower are much easier to remember and use.

APPENDIX A

Using the 6800 Mnemonic Assembler with a disk will allow quick and efficient assembly of any size file, as long as it will fit on the disk. The diskette is setup to run on a 16K system but can be modified for other RAM sizes. See "Adaptions" in this appendix for details.

The assembler is stored on the diskette as a transient command. The syntax for its use is as follows:

ASMB, FILE, OBJECT, P, N, N

Where 'FILE' is the name of the source file to be assembled, 'OBJECT' is the optional file name where the assembled object code will be put, 'P' is an optional parameter to route the assembled source listing to a printer (see 'Adaptions') 'N' is an optional parameter to surpress the listing except for errors (no list), and the second 'N' is an optional parameter to surpress the symbol sort and print out (no symbols).

Some examples will demonstrate its use.

ASMB,TEST	Assemble the source file 'TEST' and print the listing on the terminal.
ASMB,TEST,TEST.B	Assemble the file 'TEST' and put the object code on the disk in file called 'TEST.B'. Print on the terminal.
ASMB,TEST,,,N,N	Assemble 'TEST' without a listing or symbol table.
ASMB,TEST,,P	Assemble 'TEST' and route listing to the printer.
ASMB,TEST,TEST.B,P	Assemble 'TEST' putting the object code in 'TEST.B' and routing listing to the printer.

If any non-recoverable disk errors occur, the assembler will return to DOS without completing the assembly.

Adaptions

To make any changes in the assembler, you must first load it into RAM. This can be done by typing 'ASMB' followed immediately by a carriage return. When the prompt is printed, exit DOS, make the changes using the monitor, and re-enter DOS. At this time use the SAVE command to save the new version. The execution entry point (starting address) is location $1615.

I. Printer Routines

The assembler calls two printer routines. One is for parallel port and printer initiatization (PRNINT) and is called from location $1635. It is currently just a call to MIKBUG's output routine. The second routine for actual character output to the printer (POUCH) is called from $1632. It is currently set to MIKBUG's output routine.

There are 64 bytes starting at location $196F reserved for these printer routines. The POUCH routine should preserve the contents of the B and X registers.

II. Memory Size

The assembler has 2 buffer spaces which use the RAM unoccupied by the assembler itself. One of these is for the source buffer, the other is for the symbol table. The pointer locations are as follows:

BUFFER END	$1641	(LPTBEG)
LABLE TABLE END	$164B	(LPTEND)

The table below shows the values for these pointers and the approximate number of symbols the assembler will support for RAM sizes from 8K to 28K. The assembler is currently set up for a 16K system.

RAM SIZE	LPTBEG ($1641)	LPTEND ($164B)	SYMBOLS
8K	$1CØØ	$1FFF	120
12K	$2800	$2FFF	225
16K	$3000	$3FFF	500
20K	$3800	$4FFF	700
24K	$4000	$5FFF	1000
28K	$5000	$6FFF	1000

APPENDIX B

Source Listing

```
 LOCN B1 B2 B3
                    *
                    *
                    * SSB 6800 SUPER ASSEMBLER
                    *  COPYRIGHT 1977 (C) BY
                    *
                    * TECHNICAL SYSTEMS CONSULTANTS, INC.
                    * PO BOX 2574
                    * WEST LAFAYETTE, INDIANA 47906
                    *
                    *



                    *
                    * INSTRUCTION TYPES
                    *  TYPE 1     INHERENT
                    *  TYPE 2     RELATIVE
                    *  TYPE 3     INDEXED,EXTENDED    0,1
                    *  TYPE 4     DIRECT,INDEXED,EXTENDED    0,1,2
                    *  TYPE 5     IMMEDIATE,DIRECT,INDEXED,EXTENDED  0,1,2,3
                    *  TYPE 6     INHERENT (A,B),INDEXED,EXTENDED 0,1,2,3
                    *  TYPE 7     INHERENT (A,B)  0,1
                    *  TYPE 8     FCC
                    *  TYPE 9     FCB
                    *  TYPE 10    FDB
                    *  TYPE 11    SPC
                    *  TYPE 12    OPT
                    *  TYPE 13    PAG
                    *  TYPE 14    ORG
                    *  TYPE 15    EQU
                    *  TYPE 16    END,MON
                    *  TYPE 17    NAM,TTL
                    *  TYPE 18    RMB
                    *
                    *
                    *  ERROR TYPES
                    *
                    *  0    SYMBOL TABLE FULL
                    *  1    UNDEFINED SYMBOL
                    *  2    MULTIPLY DEFINED SYMBOL
                    *  3    UNRECOGNIZABLE MNEMONIC
                    *  4    ILLEGAL CHARACTER IN LABEL
                    *  5    ILLEGAL CHARACTER IN OPERAND
                    *  6    RELATIVE BRANCH TOO LONG
                    *  7    SYNTAX ERROR
                    *  8    ILLEGAL INDEX VARIABLE
                    *  9    ILLEGAL CHARACTER FOR SPECIFIED BASE
                    * 10    ILLEGAL OPTION SWITCH
                    * 11    TOO MANY OPERANDS IN DATA STATEMENT
                    *
                    *
                    *  STORAGE
                          ORG     $40
                    *
0040                LBLBEG  RMB     2
0042                LBLEND  RMB     2
```

```
LOCN B1 B2 B3
0044             SRCBEG   RMB     2
0046             SRCEND   RMB     2
0048             LINBYT   RMB     1
0049             MEMOBJ   RMB     2
004B             PC       RMB     2
004D             SRCPTR   RMB     2
004F             LABEL    RMB     6
0055             PRFLG    RMB     1
0056             ERRFLG   RMB     1
0057             MATFLG   RMB     1
0058             ENDFLG   RMB     1
0059             PCFLAG   RMB     1
005A             DATFLG   RMB     1
005B             FCCFLG   RMB     1
005C             EJFLG    RMB     1
005D             P3FLG    RMB     1
005E             PRTFLG   RMB     1
005F             PAGFLG   RMB     1
0060             LBLMSK   RMB     1
0061             CKSUM    RMB     1
0062             OBJINT   RMB     1
0063             OPN      RMB     1
0064             TERM     RMB     1
0065             XSAVE    RMB     2
0067             SPSAVE   RMB     2
0069             XTEMP    RMB     2
006B             XTEMP1   RMB     2
006D             XTEMP2   RMB     2
006F             XTEMP3   RMB     2
0071             XTEMP4   RMB     2
0073             XTEMP5   RMB     2
0075             LTEMP    RMB     2
0077             QTEMP3   RMB     2
0079             QTEMP2   RMB     2
007B             QTEMP    RMB     2
007D             TEMP     RMB     1
007E             OPCODE   RMB     1
007F             OP1      RMB     1
0080             OP2      RMB     1
0081             P2ERR1   RMB     1
0082             P2ERR2   RMB     1
0083             P2ERR3   RMB     1
0084             LSTERR   RMB     1
0085             ERRPTR   RMB     2
0087             BYTPTR   RMB     2
0089             OBJPTR   RMB     2
008B             MEMPTR   RMB     2
008D             LINPTR   RMB     2
008F             PASS     RMB     1
0090             OPCNT    RMB     1
0091             RNDM     RMB     3
0094             OPTPTR   RMB     2
0096             OPNPTR   RMB     2
0098             SAVPTR   RMB     2
009A             MCOUNT   RMB     2
```

```
LOCN B1 B2 B3
009C             LSTPCM  RMB    2
009E             LASTPC  RMB    2
00A0             OBJADR  RMB    2
00A2             LASTM   RMB    2
00A4             HASHCT  RMB    1
00A5             ERRCNT  RMB    1
00A6             BYTCNT  RMB    1
00A7             BUFCNT  RMB    1
00A8             LINCNT  RMB    1
00A9             ERRORS  RMB    1
00AA             GAP     RMB    1
00AB             MODFY   RMB    1
00AC             PAGENO  RMB    2
00AE             LIST    RMB    1
00AF             SYMBOL  RMB    1
00B0             GENER   RMB    1
00B1             PAGER   RMB    1
00B2             TAPE    RMB    1
00B3             MEMORY  RMB    1
00B4             OBJBUF  RMB    18
00C6             TITLE   RMB    33
                 *
                 *
                 *
      0036       LINES   EQU    54
      000A       EJCHR   EQU    $0A
                 *
                 *
                         ORG    $100
0100             ERRSTK  RMB    256
0200             BYTSTK  RMB    256
                 *
                 *
0300 8E A0 7F    MAIN    LDS    #$A07F     SET STACK ************
0303 BD 03 26            JSR    P1INIT
0306 BD 03 B1            JSR    PASONE
0309 BD 03 6F            JSR    P2INIT
030C BD 03 D9            JSR    PASTWO
030F BD 03 26            JSR    P1INIT
0312 BD 03 B1            JSR    PASONE
0315 BD 03 6F            JSR    P3INIT
0318 BD 05 BB            JSR    PASTHR
                 *
                 * EXTERNAL LINKAGES
031B 7E E0 D0    MON     JMP    $E0D0        RETURN TO MONITOR  PROGRAM
031E 86 20       OUTS    LDA A  #'
0320 7E E1 D1    OUTCH   JMP    $E1D1
0323 7E E1 D1    TAPOUT  JMP    $E1D1
                 *
                 *
                 *
                 ** P1INIT
                 * PASS 1 INITIALIZATION.  MUST BE
                 * RUN BEFORE A SERIES OF PASS 1 RUNS.
0326 86 FF       P1INIT  LDA A  #$FF
```

```
LOCN B1 B2 B3
0328 97 AE              STA A  LIST
032A 97 B0              STA A  GENER
032C 97 AF              STA A  SYMBOL
032E 97 59              STA A  PCFLAG
0330 40                 NEG A
0331 97 A8              STA A  LINCNT     INITIALIZE COUNT
0333 4F                 CLR A
0334 97 B1              STA A  PAGER      SET 'OFF' OPTIONS
0336 97 AC              STA A  PAGENO
0338 97 AD              STA A  PAGENO+1
033A 97 A5              STA A  ERRCNT     SET COUNT
033C 97 56              STA A  ERRFLG     CLEAR FLAG
033E 97 B2              STA A  TAPE
0340 97 B3              STA A  MEMORY
0342 97 58              STA A  ENDFLG     CLR FLAG
0344 97 A9              STA A  ERRORS
0346 86 7F              LDA A  #$7F
0348 97 60              STA A  LBLMSK     SET MASK
034A CE 01 00           LDX    #ERRSTK
034D DF 85              STX    ERRPTR     SET POINTER
034F DE 40              LDX    LBLBEG     GET LABEL TABLE START
0351 6F 00      CLRLBL  CLR    0,X        SET WHOLE TABLE TO 0
0353 08                 INX
0354 9C 42              CPX    LBLEND     CHECK DONE
0356 26 F9              BNE    CLRLBL     LOOP TILL DONE
0358 CE 00 C6           LDX    #TITLE
035B 86 20              LDA A  #'
035D A7 00      SETTL   STA A  0,X
035F 08                 INX
0360 8C 00 E6           CPX    #TITLE+32  CHECK ALL DONE
0363 26 F8              BNE    SETTL      GO FINISH
0365 86 04              LDA A  #4
0367 A7 00              STA A  0,X        SET EOT
0369 CE 00 00           LDX    #0
036C DF 4B              STX    PC         SET PC TO 0
036E 39                 RTS
                *
                *
                ** P2INIT
                * PASS 2 INITIALIZATION.  MUST BE RUN
                * BEFORE A SERIES OF PASS 2 RUNS.
036F 86 FF      P2INIT  LDA A  #$FF
0371 97 62              STA A  OBJINT     SET TOGGLE
0373 97 5D              STA A  P3FLG      SET NOT PASS 3
0375 CE 01 00           LDX    #ERRSTK
0378 DF 85              STX    ERRPTR     INITIALIZE ERROR PTR
037A CE 00 00           LDX    #0
037D DF 4B              STX    PC         INITIALIZE PC
037F CE FF FF           LDX    #$FFFF
0382 DF 9C              STX    LSTPCM
0384 DF 9E              STX    LASTPC     SET OBJECT PC'S
0386 4F                 CLR A
0387 97 A7              STA A  BUFCNT
0389 97 9A              STA A  MCOUNT
038B 97 9B              STA A  MCOUNT+1
```

```
LOCN B1 B2 B3
038D 97 58              STA A  ENDFLG     CLEAR FLAG
038F CE 00 B4           LDX    #OBJBUF
0392 DF 89              STX    OBJPTR     SET OBJECT PTR
0394 DE 49              LDX    MEMOBJ
0396 DF 8B              STX    MEMPTR     SET  MEMORY PTR
0398 DF A2              STX    LASTM
039A DE 40              LDX    LBLBEG     GET LABEL PTR
039C A6 00      SETBIT  LDA A  0,X        GET FIRST CHAR
039E 27 04              BEQ    NOLAB      IF 0, NO LABEL
03A0 8A 80              ORA A  #$80       SET FLAG BIT
03A2 A7 00              STA A  0,X        PUT BACK
03A4 C6 08      NOLAB   LDA B  #8         SET COUNT
03A6 08         ADVPTR  INX               MOVE PTR
03A7 9C 42              CPX    LBLEND     SEE IF DONE
03A9 27 05              BEQ    P2IN3
03AB 5A                 DEC B
03AC 26 F8              BNE    ADVPTR     SEE IF AT NEW POSITION
03AE 20 EC              BRA    SETBIT     GO SET NEXT FLAG
03B0 39         P2IN3   RTS
                *
                *
                ** P3INIT
                * PASS 3 INITIALIZATION
     036F       P3INIT  EQU    P2INIT     SAME AS PASS 2
                *
                *
                ** PASONE
                * PERFORMS ASSEMBLY PASS 1
03B1 9F 67      PASONE  STS    SPSAVE     SAVE SP
03B3 DE 44              LDX    SRCBEG     GET SOURCE POINTER
03B5 09                 DEX               ADJUST
03B6 7F 00 8F           CLR    PASS       SET PASS1
03B9 DF 4D      PASS1   STX    SRCPTR     SAVE PTR
03BB BD 0B 75           JSR    PARSE      PARSE UP THE LINE
03BE DF 6F              STX    XTEMP3     SAVE SOURCE POINTER
03C0 96 4F              LDA A  LABEL      GET FIRST CHAR OF LAB.
03C2 27 03              BEQ    PASS11     IF NO LABEL
03C4 BD 08 A2           JSR    PUTLBL     GO INSTALL LABEL
03C7 96 55      PASS11  LDA A  PRFLG      GET PROCESS FLAG
03C9 26 03              BNE    PASS12     IF SET, PROCESS
03CB BD 0C 44           JSR    FND222     GO GET OPERATOR
03CE DE 6F      PASS12  LDX    XTEMP3     GET SOURCE PTR
03D0 96 58              LDA A  ENDFLG
03D2 26 04              BNE    PASS13
03D4 9C 46              CPX    SRCEND     CHECK DNE
03D6 26 E1              BNE    PASS1      IF NOT, LOOP
03D8 39         PASS13  RTS
                *
                *
                *
                ** PASTWO
                * PERFORMS ASSEMBLY PASS 2
03D9 DE 44      PASTWO  LDX    SRCBEG     POINT TO BEGIN. SOURCE
03DB 09                 DEX               ADJUST
03DC 86 01              LDA A  #$01
```

```
LOCN B1 B2 B3
03DE 97 8F            STA A  PASS      SET PASS 2
03E0 DF 4D     PASS2  STX    SRCPTR    SAVE POINTER
03E2 DE 4B            LDX    PC
03E4 DF 6D            STX    XTEMP2    SAVE PC
03E6 DE 4D            LDX    SRCPTR    GET POINTER
03E8 BD 0B 75  PASS2A JSR    PARSE     GO PARSE THE LINE
03EB DF 6F            STX    XTEMP3    SAVE PTR
03ED 96 4F            LDA A  LABEL     GET FIRST CHAR
03EF 27 09            BEQ    PASS2B    IF NOT THERE, SKIP
03F1 BD 09 05         JSR    FNDLBL    LOCATE LABEL
03F4 A6 00            LDA A  0,X       GET FIRST CHAR
03F6 84 7F            AND A  #$7F      RESET BIT
03F8 A7 00            STA A  0,X       PUT BACK
03FA 96 55     PASS2B LDA A  PRFLG     GET PROCESS FLAG
03FC 26 03            BNE    PASS2X    IF SET, DONT PROCESS
03FE BD 09 1F         JSR    FNDOPT    GET OPERATION
0401 96 90     PASS2X LDA A  OPCNT     CHECK BYTE COUNT
0403 27 16            BEQ    PASS2C    IF 0, SKIP
0405 96 5D            LDA A  P3FLG     CHECK PASS 3
0407 27 04            BEQ    OBJGEN    IF SO, GO GENERATE CODE
0409 96 B2            LDA A  TAPE      SEE IF TAPE ON
040B 27 07            BEQ    MEMGEN    IF NOT, CHECK MEMORY
040D BD 14 89  OBJGEN JSR    OBJCOD    GO GENERATE CODE
0410 96 5D            LDA A  P3FLG     CHECK PASS3
0412 27 07            BEQ    PASS2C    IF SO, SKIP MEMORY
0414 96 B3     MEMGEN LDA A  MEMORY    SEE IF MEMORY ON
0416 27 03            BEQ    PASS2C    IF NOT, SKIP
0418 BD 15 77         JSR    MEMCOD    GO PUT IN MEMORY
041B 96 5D     PASS2C LDA A  P3FLG     CHECK PASS3
041D 26 03            BNE    SHORT
041F 7E 04 A4         JMP    NOERR4
0422 96 5E     SHORT  LDA A  PRTFLG    SEE IF PRINT
0424 27 0D            BEQ    CHK2ER    IF NOT, SKIP
0426 96 AE            LDA A  LIST      GET LIST FLAG
0428 27 09            BEQ    CHK2ER    SKIP IF NO LIST
042A 96 90            LDA A  OPCNT
042C 36               PSH A
042D BD 05 C1         JSR    PRTINF    GO PRINT DATA
0430 32               PUL A
0431 97 90            STA A  OPCNT     RESTORE COUNT
0433 86 FF     CHK2ER LDA A  #$FF
0435 97 56            STA A  ERRFLG    SET FLAG
0437 96 A5     CHKERR LDA A  ERRCNT    GET COUNT
0439 27 3A            BEQ    NOERR     IF 0, NO ERRORS
043B DE 85            LDX    ERRPTR    GET POINTER
043D EE 00            LDX    0,X       GET ERR ADDRESS
043F 9C 4D            CPX    SRCPTR    CHECK IF HERE
0441 26 32            BNE    NOERR     IF NOT, NO ERROR
0443 96 AE            LDA A  LIST      GET LIST FLAG
0445 26 06            BNE    GETERR    IF LIST ON, SOURCE PRINTED
0447 BD 05 FF         JSR    PRTDAT    PRINT DATA
044A BD 06 42         JSR    PRTSRC  GO PRINT SOURCE TOO
044D DE 85     GETERR LDX    ERRPTR    GET ERROR PTR
044F 7A 00 A5         DEC    ERRCNT    COUNT ONE DOWN
0452 E6 02            LDA B  2,X       GET TYPE
```

```
LOCN B1 B2 B3
0454 27 15          BEQ     GETER2
0456 D1 81          CMP B   P2ERR1      CHECK SAME
0458 26 03          BNE     CHK2
045A 7F 00 81       CLR     P2ERR1
045D D1 82    CHK2  CMP B   P2ERR2
045F 26 03          BNE     CHK3
0461 7F 00 82       CLR     P2ERR2
0464 D1 83    CHK3  CMP B   P2ERR3
0466 26 03          BNE     GETER2
0468 7F 00 83       CLR     P2ERR3
046B 08       GETER2 INX
046C 08             INX
046D 08             INX
046E DF 85          STX     ERRPTR      STORE NEW PTR
0470 BD 06 51       JSR     PRTERR      GO INSERT ERROR MESSAGE
0473 20 C2          BRA     CHKERR      GO SEE IF MORE ERRORS
0475 CE 00 81 NOERR LDX     #P2ERR1     POINT TO STORE
0478 86 03          LDA A   #3          SET COUNT
047A 36       CERR  PSH A               SAVE COUNT
047B DF 77          STX     QTEMP3      SAVE PLACE
047D E6 00          LDA B   0,X         GET ERROR
047F 27 15          BEQ     CNXT        IF 0, GO NEXT
0481 96 56          LDA A   ERRFLG      GET FLAG
0483 27 0A          BEQ     PRT2ER
0485 96 AE          LDA A   LIST        CHECK LIST ON
0487 26 06          BNE     PRT2ER
0489 BD 05 FF       JSR     PRTDAT
048C BD 06 42       JSR     PRTSRC      PRINT INFO
048F DE 77    PRT2ER LDX    QTEMP3      GET POINTER
0491 E6 00          LDA B   0,X         GET ERROR
0493 BD 06 51       JSR     PRTERR      GO PRINT MESG
0496 DE 77    CNXT  LDX     QTEMP3      GET POINTER
0498 08             INX                 POINT NEXT
0499 32             PUL A   GET COUNT
049A 4A             DEC A               ONE DONE
049B 26 DD          BNE     CERR        LOOP TILL DONE
049D 96 5F    NOERR2 LDA A  PAGFLG      CHECK PAGE FLAG
049F 26 03          BNE     NOERR4
04A1 BD 11 31       JSR     EJECT
04A4 DE 6F    NOERR4 LDX    XTEMP3      GET SOURCE PTR
04A6 96 58          LDA A   ENDFLG
04A8 26 2C          BNE     FIN
04AA 9C 46          CPX     SRCEND      CHECK IF DONE
04AC 27 03          BEQ     P2DON
04AE 7E 03 E0       JMP     PASS2
04B1 39       P2DON RTS
              *
              ** CONTRL
              * OUTPUT TAPE CONTROL CHARACTERS
04B2 C6 04    CONTRL LDA B  #4          SET 4 CHARS
04B4 27 09          BEQ     CONDON
04B6 A6 00    PCTRL LDA A   0,X
04B8 BD 03 23       JSR     TAPOUT
04BB 08             INX
04BC 5A             DEC B
```

```
LOCN B1 B2 B3
04BD 26 F7              BNE     PCTRL
04BF 39         CONDON  RTS
04C0 00         TAPEON  FCB     0,0,0,0
04C1 00
04C2 00
04C3 00
04C4 00         TAPEOF  FCB     0,0,0,0
04C5 00
04C6 00
04C7 00
                *
                ** DELAY
                * DELAY FOR TAPE CONTROL
04C8 C6 04      DELAY   LDA B   #4
04CA 27 09              BEQ     DELDON
04CC CE F4 FF   XLOOP   LDX     #$F4FF      SET COUNTER
04CF 09         DECX    DEX
04D0 26 FD              BNE     DECX
04D2 5A                 DEC B
04D3 26 F7              BNE     XLOOP
04D5 39         DELDON  RTS
                *
                *
                *
                ** FIN
                * END OF ASSEMBLY CLEAN UP
04D6 96 5D      FIN     LDA A   P3FLG       CHECK PASS3
04D8 27 17              BEQ     LSTREC      IF SO, PUNCH LAST RECORD
04DA BD 07 BA           JSR     PCRLF       CR LF
04DD BD 06 39           JSR     PRT2
04E0 CE 05 49           LDX     #NOERHD
04E3 96 A9              LDA A   ERRORS      SEE IF ANY ERRORS
04E5 27 03              BEQ     PRTMES      IF NOT, GOT PTR
04E7 CE 05 4B           LDX     #ERRHD      MESSAGE
04EA BD 07 AB   PRTMES  JSR     PDATA       PRINT IT
04ED 96 B2      CHKTAP  LDA A   TAPE        SEE IF TAPE ON
04EF 27 14              BEQ     FIN2        IF NOT, SKIP
04F1 BD 15 18   LSTREC  JSR     PRTREC      GO PUNCH LAST
04F4 86 53              LDA A   #'S
04F6 BD 03 23           JSR     TAPOUT
04F9 86 39              LDA A   #'9
04FB BD 03 23           JSR     TAPOUT      PUNCH S9
04FE 8D C8              BSR     DELAY       DELAY BEFORE TURN OFF
0500 CE 04 C4           LDX     #TAPEOF
0503 8D AD              BSR     CONTRL
0505 96 5D      FIN2    LDA A   P3FLG       CHECK PASS3
0507 27 2E              BEQ     FIN6        IF SO, SKIP
0509 96 B3              LDA A   MEMORY      CHECK MEMORY OPTION
050B 27 09              BEQ     FIN5        IF OFF, SKIP
050D BD 15 F4           JSR     FIXCNT      GO SET BYTE COUNT
0510 DE 8B              LDX     MEMPTR      GET POINTER
0512 6F 00      SET0    CLR     0,X
0514 6F 01              CLR     1,X
0516 96 AF      FIN5    LDA A   SYMBOL      CHECK SYMBOL ON
0518 26 44              BNE     SYMGEN      IF SO, GO PRINT
```

```
LOCN B1 B2 B3
051A 96 AE            LDA A  LIST      SEE IF LIST ON
051C 27 19            BEQ    FIN6      IF NOT, SKIP
051E BD 07 BA  FIN3   JSR    PCRLF     CR LF
0521 96 B1            LDA A  PAGER     SEE IF PAGE ON
0523 27 0A            BEQ    FIN4      IF NOT, SKIP
0525 96 B1            LDA A  PAGER     SEE IF PAGE ON
0527 27 06            BEQ    FIN4      IF NOT, SKIP
0529 CE 11 D1         LDX    #EJSTR
052C 7E 07 AB         JMP    PDATA     PAGE EJECT
052F C6 04     FIN4   LDA B  #4
0531 BD 07 BA  GAPX   JSR    PCRLF
0534 5A               DEC B
0535 26 FA            BNE    GAPX      PRINT 4 LINES
0537 39        FIN6   RTS               DONE
0538 20        SYMHD  FCC    '   SYMBOL TABLE:'
0539 20
053A 20
053B 53
053C 59
053D 4D
053E 42
053F 4F
0540 4C
0541 20
0542 54
0543 41
0544 42
0545 4C
0546 45
0547 3A
0548 04               FCB    4
0549 4E        NOERHD FCC    'NO'
054A 4F
054B 20        ERRHD  FCC    ' ERROR(S) DETECTED'
054C 45
054D 52
054E 52
054F 4F
0550 52
0551 28
0552 53
0553 29
0554 20
0555 44
0556 45
0557 54
0558 45
0559 43
055A 54
055B 45
055C 44
055D 04               FCB    4
               *
               *
               ** SYMGEN
```

```
LOCN B1 B2 B3
                    * SORT AND PRINT SYMBOL TABLE
055E 96 5D          SYMGEN  LDA A   P3FLG       CHECK PASS 3
0560 27 BC                  BEQ     FIN3        IF SO, DONE
0562 C6 04                  LDA B   #4
0564 BD 0F D9               JSR     TYP11A      GO SPACE 4
0567 CE 05 38               LDX     #SYMHD
056A BD 07 AB               JSR     PDATA       PRINT HEADER
056D BD 13 F0               JSR     SHELL       GO SORT
0570 DE 40                  LDX     LBLBEG
0572 09                     DEX
0573 DF 69                  STX     XTEMP       SET POINTER
0575 BD 07 BA       LSTSYM  JSR     PCRLF
0578 C6 04                  LDA B   #4          SET 4 LABELS
057A DE 69          GETSYM  LDX     XTEMP       GET POINTER
057C 08                     INX
057D A6 00                  LDA A   0,X
057F 27 29                  BEQ     NOPRT       IF 0, NO LABEL
0581 37                     PSH B
0582 C6 06                  LDA B   #6          SET 6 CHARS
0584 A6 00          LABOUT  LDA A   0,X         GET CHAR
0586 BD 03 20               JSR     OUTCH       PRINT IT
0589 08                     INX
058A 5A                     DEC B               CHECK DONE
058B 26 F7                  BNE     LABOUT
058D BD 0C C7               JSR     OUT2S       PRINT 2 SPACES
0590 A6 00                  LDA A   0,X         GET MS ADDRESS
0592 BD 0C D0               JSR     OUTHEX      PRINT IT
0595 08                     INX
0596 A6 00                  LDA A   0,X         GET LS VALUE
0598 BD 0C D0               JSR     OUTHEX      PRINT IT
059B DF 69                  STX     XTEMP       SAVE PTR LOCATION
059D BD 06 39               JSR     PRT2        PRINT 7 SPACES
05A0 33                     PUL B               GET LINE COUNT
05A1 9C 42                  CPX     LBLEND      CHECK TABLE DONE
05A3 27 13                  BEQ     SYMPRT
05A5 5A             CONT    DEC B               SEE IF 4 YET
05A6 26 D2                  BNE     GETSYM      IF NOT, DO AGAIN
05A8 20 CB                  BRA     LSTSYM      OTHERWISE, START NEW LINE
05AA 37             NOPRT   PSH B
05AB C6 07                  LDA B   #7
05AD 08             MOVPTR  INX
05AE 5A                     DEC B
05AF 26 FC                  BNE     MOVPTR      ADVANCE PTR
05B1 33                     PUL B
05B2 DF 69                  STX     XTEMP       SAVE PTR
05B4 9C 42                  CPX     LBLEND      CHECK DONE
05B6 26 C2                  BNE     GETSYM
05B8 7E 05 1E       SYMPRT  JMP     FIN3
                    *
                    *
                    ** PASTHR
                    * PERFORM ASSEMBLY PASS 3
05BB 7F 00 5D       PASTHR  CLR     P3FLG       SET PASS 3
05BE 7E 03 D9               JMP     PASTWO      DO PASS 2
                    *
```

```
LOCN B1 B2 B3
                    ** PRTINF
                    * PRINT ASSEMBLED DATA
05C1 8D 3C          PRTINF  BSR     PRTDAT      GO PRINT ADDR, DATA
05C3 8D 7D                  BSR     PRTSRC      PRINT SOURCE
05C5 CE 02 00               LDX     #BYTSTK
05C8 DF 71                  STX     XTEMP4      SET MULTIPLE DATA PTR
05CA 96 5A                  LDA A   DATFLG      CHECK MULTIPLE
05CC 26 01                  BNE     PRTINA      IF SET, ITS THERE
05CE 39             PRTIND  RTS                 DONE
05CF 96 B0          PRTINA  LDA A   GENER       CHECK GENERATE FLAG
05D1 27 FB                  BEQ     PRTIND      IF CLR, NO PRINT
05D3 96 90          PRTINE  LDA A   OPCNT       GET OPERAND COUNT
05D5 DE 6D          PRTINB  LDX     XTEMP2      GET OLD PC
05D7 08             PRTINC  INX                 BUMP
05D8 4A                     DEC A               DO UNTIL PAST PRINTED
05D9 26 FC                  BNE     PRTINC
05DB DF 6D                  STX     XTEMP2      SAVE NEW PRINTABLE PC
05DD 86 01                  LDA A   #1
05DF 97 90                  STA A   OPCNT       SET COUNT
05E1 DE 71                  LDX     XTEMP4      GET STACK PTR
05E3 9C 87                  CPX     BYTPTR      CHECK FOR DATA
05E5 27 E7                  BEQ     PRTIND      IF NO DATA, EXIT
05E7 A6 00                  LDA A   0,X         GET CHAR (BYTE)
05E9 97 7E                  STA A   OPCODE      PUT IN PLACE
05EB 08                     INX                 BUMP POINTER
05EC 9C 87                  CPX     BYTPTR      CHECK MORE DATA
05EE 27 08                  BEQ     PRTING      IF NO, DONE
05F0 7C 00 90               INC     OPCNT       SET COUNT =2
05F3 A6 00                  LDA A   0,X         GET NEXT BYTE
05F5 97 7F                  STA A   OP1         PUT IN PLACE
05F7 08                     INX                 BUMP PTR
05F8 DF 71          PRTING  STX     XTEMP4      SAVE POINTER
05FA BD 05 FF               JSR     PRTDAT      GO PRINT DATA
05FD 20 D4                  BRA     PRTINE      LOOP TILL DONE
                    *
                    *
                    ** PRTDAT
                    * PRINT ADDRESS AND DATA
05FF BD 07 BA       PRTDAT  JSR     PCRLF       GO DO CR LF
0602 BD 03 1E               JSR     OUTS        PRINT A SP
0605 96 59                  LDA A   PCFLAG      CHECK FOR PRINT PC
0607 26 08                  BNE     PRTPC       IF SET, DO IT
0609 BD 0C C7               JSR     OUT2S
060C BD 0C C5               JSR     OUT3S       SKIP FIELD
060F 20 25                  BRA     PRT1
0611 96 6D          PRTPC   LDA A   XTEMP2      GET CURRENT PC
0613 BD 0C D0               JSR     OUTHEX      PRINT MS
0616 96 6E                  LDA A   XTEMP2+1    GET LS
0618 BD 0C CC               JSR     OUTHXS      PRINT IT
061B D6 90                  LDA B   OPCNT       GET COUNT
061D 27 17                  BEQ     PRT1
061F 96 7E                  LDA A   OPCODE
0621 BD 0C CC               JSR     OUTHXS      PRINT OPCODE
0624 5A                     DEC B
0625 27 12                  BEQ     PRT2        SEE IF DONE
```

```
LOCN B1 B2 B3
0627 96 7F            LDA A  OP1
0629 BD 0C CC         JSR    OUTHXS     PRINT IT
062C 5A               DEC B
062D 27 0D            BEQ    PRT3
062F 96 80            LDA A  OP2
0631 BD 0C CC         JSR    OUTHXS
0634 20 09            BRA    PRT4
0636 BD 0C C5  PRT1   JSR    OUT3S
0639 BD 0C C5  PRT2   JSR    OUT3S
063C BD 0C C5  PRT3   JSR    OUT3S
063F 7E 03 1E  PRT4   JMP    OUTS
                      *
                      ** PRTSRC
                      * PRINT A LINE OF SOURCE
0642 DE 8D     PRTSRC LDX    LINPTR     GET POINTER
0644 A6 00     PRTS1  LDA A  0,X        GET A CHAR
0646 08               INX              POINT NEXT
0647 81 0D            CMP A  #$D       CHECK FOR CR
0649 27 05            BEQ    PRTS2     IF SO, DONE
064B BD 03 20         JSR    OUTCH     PRINT IT
064E 20 F4            BRA    PRTS1     DO AGAIN
0650 39        PRTS2  RTS               DONE
                      *
                      ** PRTERR
                      * INSERT ERROR MESSAGE INTO LISTING
0651 CE 06 81  PRTERR LDX    #MSGHD
0654 BD 07 B2         JSR    PSTR      PRINT HEADING
0657 7F 00 56         CLR    ERRFLG    SET PRINTED FLAG
065A CE 06 69         LDX    #MSGTBL   POINT TO TABLE
065D 58               ASL B            MULT ERROR # * 2
065E 27 04            BEQ    GOTMSG    CHECK IF GOT
0660 08        PTNXT  INX              POINT NEXT ADDRESS
0661 5A               DEC B            COUNT OFF
0662 26 FC            BNE    PTNXT     CYCLE
0664 EE 00     GOTMSG LDX    0,X       GET TEXT POINTER
0666 7E 07 AB         JMP    PDATA     GO PRINT MESG
                      *
0669 06 87     MSGTBL FDB    MESG0
066B 06 9D            FDB    MESG1
066D 06 AE            FDB    MESG2
066F 06 C6            FDB    MESG3
0671 06 DE            FDB    MESG4
0673 06 F9            FDB    MESG5
0675 07 16            FDB    MESG6
0677 07 2F            FDB    MESG7
0679 07 3C            FDB    MESG8
067B 07 53            FDB    MESG9
067D 07 78            FDB    MESG10
067F 07 8E            FDB    MESG11
                      *
0681 2A        MSGHD  FCC    '**   '
0682 2A
0683 20
0684 20
0685 20
```

```
LOCN B1 B2 B3
0686 04                  FCB    4
                    *
0687 53             MESG0  FCC    'SYMBOL TABLE OVERFLOW'
0688 59
0689 4D
068A 42
068B 4F
068C 4C
068D 20
068E 54
068F 41
0690 42
0691 4C
0692 45
0693 20
0694 4F
0695 56
0696 45
0697 52
0698 46
0699 4C
069A 4F
069B 57
069C 04                  FCB    4
069D 55             MESG1  FCC    'UNDEFINED SYMBOL'
069E 4E
069F 44
06A0 45
06A1 46
06A2 49
06A3 4E
06A4 45
06A5 44
06A6 20
06A7 53
06A8 59
06A9 4D
06AA 42
06AB 4F
06AC 4C
06AD 04                  FCB    4
06AE 4D             MESG2  FCC    'MULTIPLY DEFINED SYMBOL'
06AF 55
06B0 4C
06B1 54
06B2 49
06B3 50
06B4 4C
06B5 59
06B6 20
06B7 44
06B8 45
06B9 46
06BA 49
06BB 4E
```

```
LOCN B1 B2 B3
06BC 45
06BD 44
06BE 20
06BF 53
06C0 59
06C1 4D
06C2 42
06C3 4F
06C4 4C
06C5 04                 FCB     4
06C6 55         MESG3   FCC     'UNRECOGNIZABLE MNEMONIC'
06C7 4E
06C8 52
06C9 45
06CA 43
06CB 4F
06CC 47
06CD 4E
06CE 49
06CF 5A
06D0 41
06D1 42
06D2 4C
06D3 45
06D4 20
06D5 4D
06D6 4E
06D7 45
06D8 4D
06D9 4F
06DA 4E
06DB 49
06DC 43
06DD 04                 FCB     4
06DE 49         MESG4   FCC     'ILLEGAL CHARACTER IN LABEL'
06DF 4C
06E0 4C
06E1 45
06E2 47
06E3 41
06E4 4C
06E5 20
06E6 43
06E7 48
06E8 41
06E9 52
06EA 41
06EB 43
06EC 54
06ED 45
06EE 52
06EF 20
06F0 49
06F1 4E
06F2 20
```

```
LOCN B1 B2 B3
06F3 4C
06F4 41
06F5 42
06F6 45
06F7 4C
06F8 04                 FCB     4
06F9 49         MESG5   FCC     'ILLEGAL CHARACTER IN OPERAND'
06FA 4C
06FB 4C
06FC 45
06FD 47
06FE 41
06FF 4C
0700 20
0701 43
0702 48
0703 41
0704 52
0705 41
0706 43
0707 54
0708 45
0709 52
070A 20
070B 49
070C 4E
070D 20
070E 4F
070F 50
0710 45
0711 52
0712 41
0713 4E
0714 44
0715 04                 FCB     4
0716 52         MESG6   FCC     'RELATIVE BRANCH TOO LONG'
0717 45
0718 4C
0719 41
071A 54
071B 49
071C 56
071D 45
071E 20
071F 42
0720 52
0721 41
0722 4E
0723 43
0724 48
0725 20
0726 54
0727 4F
0728 4F
0729 20
```

```
LOCN B1 B2 B3
072A 4C
072B 4F
072C 4E
072D 47
072E 04                 FCB     4
072F 53         MESG7   FCC     'SYNTAX ERROR'
0730 59
0731 4E
0732 54
0733 41
0734 58
0735 20
0736 45
0737 52
0738 52
0739 4F
073A 52
073B 04                 FCB     4
073C 49         MESG8   FCC     'ILLEGAL INDEX VARIABLE'
073D 4C
073E 4C
073F 45
0740 47
0741 41
0742 4C
0743 20
0744 49
0745 4E
0746 44
0747 45
0748 58
0749 20
074A 56
074B 41
074C 52
074D 49
074E 41
074F 42
0750 4C
0751 45
0752 04                 FCB     4
0753 49         MESG9   FCC     'ILLEGAL CHARACTER FOR SPECIFIED BASE'
0754 4C
0755 4C
0756 45
0757 47
0758 41
0759 4C
075A 20
075B 43
075C 48
075D 41
075E 52
075F 41
0760 43
```

```
LOCN B1 B2 B3
0761 54
0762 45
0763 52
0764 20
0765 46
0766 4F
0767 52
0768 20
0769 53
076A 50
076B 45
076C 43
076D 49
076E 46
076F 49
0770 45
0771 44
0772 20
0773 42
0774 41
0775 53
0776 45
0777 04                 FCB     4
0778 49         MESG10  FCC     'ILLEGAL OPTION SWITCH'
0779 4C
077A 4C
077B 45
077C 47
077D 41
077E 4C
077F 20
0780 4F
0781 50
0782 54
0783 49
0784 4F
0785 4E
0786 20
0787 53
0788 57
0789 49
078A 54
078B 43
078C 48
078D 04                 FCB     4
078E 54         MESG11  FCC     'TOO MANY OPERANDS (DATA)'
078F 4F
0790 4F
0791 20
0792 4D
0793 41
0794 4E
0795 59
0796 20
0797 4F
```

```
LOCN B1 B2 B3
0798 50
0799 45
079A 52
079B 41
079C 4E
079D 44
079E 53
079F 20
07A0 28
07A1 44
07A2 41
07A3 54
07A4 41
07A5 29
07A6 04                 FCB     4
                *
                ** PDATA
                * PRINT STRINGS
07A7 BD 03 20   PLOOP   JSR     OUTCH       PRINT CHAR
07AA 08                 INX                 POINT NEXT
07AB A6 00      PDATA   LDA A   0,X         GET A CHAR
07AD 81 04              CMP A   #4          CHECK FOR EOT
07AF 26 F6              BNE     PLOOP       IF NOT,PRINT IT
07B1 39                 RTS                 DONE
                *
                ** PSTR
                * PRINT CR,LF THEN STRING
07B2 DF 65      PSTR    STX     XSAVE       SAVE X
07B4 8D 04              BSR     PCRLF
07B6 DE 65              LDX     XSAVE       GET POINTER BAC K
07B8 20 F1              BRA     PDATA       GO PRINT IT
                *
                ** PCRLF
                * PRINT CR AND LF
07BA CE 07 CF   PCRLF   LDX     #CRLF       POINT
07BD 8D EC              BSR     PDATA       GO PRINT
07BF 96 A8              LDA A   LINCNT      GET LINE COUNT
07C1 4C                 INC A
07C2 97 A8              STA A   LINCNT      BUMP IT
07C4 81 36              CMP A   #LINES      SEE IF TIME TO EJECT
07C6 22 04              BHI     PCRLF2      IF SO, GO DO IT
07C8 7F 00 5C   PCRLF1  CLR     EJFLG       CLEAR FLAG
07CB 39                 RTS                 DONE
07CC 7E 11 31   PCRLF2  JMP     EJECT       GO PAGE EJECT
07CF 0D         CRLF    FCB     $D,$A,0,0,0,0,4
07D0 0A
07D1 00
07D2 00
07D3 00
07D4 00
07D5 04
                *
                ** OPSERR
                * FATAL ERROR ROUTINE
                * GENERATES 3 NOP'S
```

```
LOCN B1 B2 B3
07D6 36          OPSERR  PSH A
07D7 86 01               LDA A  #01
07D9 97 7E               STA A  OPCODE
07DB 97 7F               STA A  OP1
07DD 97 80               STA A  OP2
07DF 97 59               STA A  PCFLAG    MAKE SURE PC ON
07E1 BD 0C 72            JSR    ADDPC3
07E4 32                  PUL A
                 *
                 ** ASMERR
                 * KEEP TRACK OF ASSEMBLY ERRORS
07E5 36          ASMERR  PSH A
07E6 97 84               STA A  LSTERR    SAVE ERROR
07E8 32                  PUL A
07E9 7D 00 56            TST    ERRFLG    CHECK ERROR SUPPRESS
07EC 26 33               BNE    ASME2     IF ON, DONT PROCESS
07EE C6 FF               LDA B  #$FF
07F0 D7 A9               STA B  ERRORS    SET FLAG
07F2 7D 00 8F            TST    PASS      CHECK PASS COUNT
07F5 26 2D               BNE    ASME3     IF NOT PASS1, SKIP
07F7 D6 A5               LDA B  ERRCNT    GET COUNT
07F9 C1 55               CMP B  #85       CHECK EXCESS
07FB 27 24               BEQ    ASME2     IF SO, IGNORE
07FD 36                  PSH A            SAVE ERROR #
07FE 96 4D               LDA A  SRCPTR    GET HIGH
0800 D6 4E               LDA B  SRCPTR+1  GET LOW
0802 DE 85               LDX    ERRPTR    GET STACK POINTER
0804 A7 00               STA A  0,X       STORE HIGH
0806 E7 01               STA B  1,X       STORE LOW
0808 32                  PUL A            GET ERROR #
0809 A7 02               STA A  2,X       SAVE #
080B 08                  INX
080C 08                  INX
080D 08                  INX              ADVANCE ERROR PTR
080E DF 85               STX    ERRPTR    SAVE IT
0810 96 A5               LDA A  ERRCNT    GET COUNT OF ERRORS
0812 4C                  INC A            KICK
0813 97 A5               STA A  ERRCNT
0815 81 55               CMP A  #85       ERROR LIMIT?
0817 26 08               BNE    ASME2
0819 CE 08 36            LDX    #TOOMAN
081C 8D 94               BSR    PSTR
081E 9E 67               LDS    SPSAVE    GET PROPER RET ADR.
0820 39                  RTS              DONE
0821 86 FF       ASME2   LDA A  #$FF
0823 39                  RTS              DONE
0824 D6 81       ASME3   LDA B  P2ERR1    CHECK EMPTY
0826 26 03               BNE    ASME4
0828 97 81               STA A  P2ERR1
082A 39                  RTS
082B D6 82       ASME4   LDA B  P2ERR2
082D 26 03               BNE    ASME5
082F 97 82               STA A  P2ERR2
0831 39                  RTS
0832 97 83       ASME5   STA A  P2ERR3
```

```
LOCN B1 B2 B3
0834 39                  RTS
0835 39                  RTS                DONE
0836 45          TOOMAN  FCC     'ERROR LIMIT EXCEEDED'
0837 52
0838 52
0839 4F
083A 52
083B 20
083C 4C
083D 49
083E 4D
083F 49
0840 54
0841 20
0842 45
0843 58
0844 43
0845 45
0846 45
0847 44
0848 45
0849 44
084A 04                  FCB     4
                 *
                 ** RANDOM
                 * RANDOM NUMBER GENERATOR USED FOR
                 * HASHING FUNCTION
084B 37          RANDOM  PSH B                   SAVE B
084C 36                  PSH A                   AND A
084D C6 18               LDA B   #24             SET FOR 24 CYCLES
084F 96 91       LOOP    LDA A   RNDM            GET FIRST BYTE
0851 48                  ASL A
0852 48                  ASL A
0853 48                  ASL A
0854 98 91               EOR A   RNDM            XOR BIT 28 WITH 31
0856 48                  ASL A
0857 48                  ASL A                   GET RESULT IN CARRY
0858 79 00 93            ROL     RNDM+2
085B 79 00 92            ROL     RNDM+1
085E 79 00 91            ROL     RNDM            SHIFT ALL LEFT WITH C
0861 5A                  DEC B                   COUNT OFF
0862 26 EB               BNE     LOOP            LOOP UNTIL DONE
0864 32                  PUL A
0865 33                  PUL B
0866 39                  RTS
                 *
                 ** HASH
                 * HASH A SYMBOL TO A TABLE ADDRESS
0867 CE 00 4F    HASH    LDX     #LABEL          GET START OF LABEL
086A 7F 00 A4            CLR     HASHCT          SET HASH COUNTER TO 0
086D A6 00               LDA A   0,X             GET FIRST CHAR
086F AB 05               ADD A   5,X
0871 97 93               STA A   RNDM+2          FOLD THE LABEL
0873 A6 01               LDA A   1,X
0875 A9 04               ADC A   4,X
```

```
LOCN B1 B2 B3
0877 97 92              STA A  RNDM+1
0879 A6 02              LDA A  2,X
087B A9 03              ADC A  3,X
087D 97 91              STA A  RNDM        AND PUT IN RANDOM GEN
087F 7C 00 A4  REHASH   INC    HASHCT      KICK COUNTER
0882 BD 08 4B  MIX2     JSR    RANDOM      MIX EM UP
0885 96 93              LDA A  RNDM+2      GET RESULT
0887 84 F8              AND A  #$F8        FIX FOR 8 BYTES
0889 D6 92              LDA B  RNDM+1
088B C4 1F              AND B  #$1F        LIMIT TO 8K
088D 9B 41              ADD A  LBLBEG+1    ADD ON BEGINNING
088F D9 40              ADC B  LBLBEG      ADDRESS OF TABLE
0891 97 6A              STA A  XTEMP+1
0893 D7 69              STA B  XTEMP       SET EFFECTIVE ADDRESS
0895 D1 42              CMP B  LBLEND
0897 22 E9              BHI    MIX2
0899 25 04              BCS    MIX3
089B 91 43              CMP A  LBLEND+1
089D 22 E3              BHI    MIX2        SEE IF IN RANGE
089F DE 69     MIX3     LDX    XTEMP       GET THE ADDRESS
08A1 39                 RTS                DONE
                *
                ** PUTLBL
                * ENTER LABEL IN SYMBOL TABLE
08A2 8D C3      PUTLBL  BSR    HASH        GO HASH IT
08A4 A6 00      CHKFRE  LDA A  0,X         GET SYMBOL ENTRY
08A6 27 13              BEQ    PUTIT       IF FREE, TAKE IT
08A8 BD 08 DE           JSR    CHKLBL      GO SEE IF SAME
08AB 27 0B              BEQ    HERROR      IF SO, MULTIPLE OCCURENCE
08AD BD 08 7F           JSR    REHASH      GO REHASH ON COLLISION
08B0 96 A4              LDA A  HASHCT      GET COUNTER
08B2 81 28              CMP A  #40         IF 40 COLLISIONS, FULL
08B4 26 EE              BNE    CHKFRE      GO SEE IF FREE
08B6 86 00              LDA A  #0          SET ERROR 0
08B8 7E 07 E5  HERROR   JMP    ASMERR      GO REPORT ERROR
08BB 96 4F     PUTIT    LDA A  LABEL       GET CHAR
08BD A7 00              STA A  0,X         PUT IN TABLE
08BF 96 50              LDA A  LABEL+1
08C1 A7 01              STA A  1,X
08C3 96 51              LDA A  LABEL+2
08C5 A7 02              STA A  2,X
08C7 96 52              LDA A  LABEL+3
08C9 A7 03              STA A  3,X
08CB 96 53              LDA A  LABEL+4
08CD A7 04              STA A  4,X
08CF 96 54              LDA A  LABEL+5
08D1 A7 05              STA A  5,X
08D3 96 4B              LDA A  PC
08D5 A7 06              STA A  6,X         STORE PC (HI)
08D7 96 4C              LDA A  PC+1
08D9 A7 07              STA A  7,X         STORE PC (LO)
08DB DF 75              STX    LTEMP       SAVE LABEL ADDRESS
08DD 39                 RTS                DONE
                *
                ** CHKLBL
```

```
LOCN B1 B2 B3
                    * SEE IF LABELS MATCH
08DE 86 02          CHKLBL  LDA A  #2          SET ERROR
08E0 E6 00                  LDA B  0,X
08E2 D4 60                  AND B  LBLMSK
08E4 D1 4F                  CMP B  LABEL
08E6 26 1C                  BNE    CKDONE      IF NO, WERE OK
08E8 D6 50                  LDA B  LABEL+1
08EA E1 01                  CMP B  1,X
08EC 26 16                  BNE    CKDONE
08EE D6 51                  LDA B  LABEL+2
08F0 E1 02                  CMP B  2,X
08F2 26 10                  BNE    CKDONE
08F4 D6 52                  LDA B  LABEL+3
08F6 E1 03                  CMP B  3,X
08F8 26 0A                  BNE    CKDONE
08FA D6 53                  LDA B  LABEL+4
08FC E1 04                  CMP B  4,X
08FE 26 04                  BNE    CKDONE
0900 D6 54                  LDA B  LABEL+5
0902 E1 05                  CMP B  5,X
0904 39             CKDONE  RTS                DONE
                    *
                    ** FNDLBL
                    * FIND A LABEL IN SYMBOL TABLE
0905 BD 08 67       FNDLBL  JSR    HASH        GO HASH IT UP
0908 A6 00          FND10   LDA A  0,X         GET ENTRY
090A 27 0E                  BEQ    FERROR      IF EMPTY, NO FIND
090C BD 08 DE               JSR    CHKLBL      GO SEE IF MATCH
090F 27 0C                  BEQ    GOTLBL      IF SO, WE GOT IT
0911 BD 08 7F               JSR    REHASH      GO MIX EM UP AGAIN
0914 96 A4                  LDA A  HASHCT      GET COUNTER
0916 81 28                  CMP A  #40         IF DO 40 TIMES, NO GOOD
0918 26 EE                  BNE    FND10       RECYCLE
091A 86 FF          FERROR  LDA A  #$FF        SET ERROR
091C 39                     RTS
091D 4F             GOTLBL  CLR A  SET FLAG
091E 39                     RTS
                    *
                    ** FNDOPT
                    * FIND OPERATOR (TYPE) AND EXECUTE
091F 4F             FNDOPT  CLR A
0920 97 5A                  STA A  DATFLG
0922 97 57                  STA A  MATFLG
0924 97 5B                  STA A  FCCFLG
0926 97 5C                  STA A  EJFLG    CLEAR FLAGS
0928 DE 96                  LDX    OPNPTR   GET POINTER
092A DF 6B                  STX    XTEMP1   SET UP
092C DE 94                  LDX    OPTPTR     GET POINTER
092E A6 02                  LDA A  2,X        GET CHAR
0930 97 7D                  STA A  TEMP       SAVE 3RD CHAR
0932 E6 01                  LDA B  1,X        GET 2ND CHAR
0934 A6 00                  LDA A  0,X        GET 1ST CHAR
0936 CE 09 6B               LDX    #OPTABL    POINT TO TABLE
0939 A1 00          CHK1    CMP A  0,X        CHECK FOR MATCH
093B 27 15                  BEQ    MATCH1     IF SO, GO SEE NEXT
```

```
LOCN B1 B2 B3
093D 7D 00 57          TST     MATFLG      CHECK FLAG
0940 26 0B             BNE     OPTERR      IF SET, NO FIND
0942 08          NOMATL INX
0943 08                 INX
0944 08                 INX
0945 08                 INX
0946 08                 INX
0947 08                 INX
0948 8C 0B 75           CPX     #OPTEND+6   CHECK END TABLE
094B 26 EC              BNE     CHK1        IF NOT, CHECK NEXT
094D 86 03       OPTERR LDA A   #3          SET ERROR NO.
094F 7E 07 D6           JMP     OPSERR      GO REPORT
0952 97 57       MATCH1 STA A   MATFLG      SET FLAG
0954 E1 01              CMP B   1,X         CHECK 2ND MATCH
0956 26 EA              BNE     NOMATL      IF NOT, RESTART
0958 36                 PSH A               SAVE CHAR
0959 96 7D              LDA A   TEMP        GET 3RD
095B A1 02              CMP A   2,X         CHECK MATCH
095D 27 03              BEQ     BINGO       IF SO, GOT IT
095F 32                 PUL A               GET 1ST AGAIN
0960 20 E0              BRA     NOMATL
0962 32          BINGO  PUL A               FIX STACK
0963 A6 03              LDA A   3,X         GET OPCODE BASE
0965 97 7E              STA A   OPCODE      SAVE
0967 EE 04              LDX     4,X         GET TYPE ADDRESS
0969 6E 00              JMP     0,X         GO SERVICE TYPE
                 *
                 * THIS IS THE MNEMONIC RECOGNITION AND
                 * BASE OPCODE TABLE
096B 41          OPTABL FCC     'ABA'
096C 42
096D 41
096E 1B                 FCB     $1B
096F 0D 03              FDB     TYPE1
0971 41                 FCC     'ADC'
0972 44
0973 43
0974 89                 FCB     $89
0975 0D 51              FDB     TYPE5
0977 41                 FCC     'ADD'
0978 44
0979 44
097A 8B                 FCB     $8B
097B 0D 51              FDB     TYPE5
097D 41                 FCC     'AND'
097E 4E
097F 44
0980 84                 FCB     $84
0981 0D 51              FDB     TYPE5
0983 41                 FCC     'ASL'
0984 53
0985 4C
0986 48                 FCB     $48
0987 0D 7B              FDB     TYPE6
0989 41                 FCC     'ASR'
```

```
LOCN B1 B2 B3
098A 53
098B 52
098C 47                     FCB     $47
098D 0D 7B                  FDB     TYPE6
098F 42                     FCC     'BCC'
0990 43
0991 43
0992 24                     FCB     $24
0993 0D 06                  FDB     TYPE2
0995 42                     FCC     'BCS'
0996 43
0997 53
0998 25                     FCB     $25
0999 0D 06                  FDB     TYPE2
099B 42                     FCC     'BEQ'
099C 45
099D 51
099E 27                     FCB     $27
099F 0D 06                  FDB     TYPE2
09A1 42                     FCC     'BGE'
09A2 47
09A3 45
09A4 2C                     FCB     $2C
09A5 0D 06                  FDB     TYPE2
09A7 42                     FCC     'BGT'
09A8 47
09A9 54
09AA 2E                     FCB     $2E
09AB 0D 06                  FDB     TYPE2
09AD 42                     FCC     'BHI'
09AE 48
09AF 49
09B0 22                     FCB     $22
09B1 0D 06                  FDB     TYPE2
09B3 42                     FCC     'BHS'
09B4 48
09B5 53
09B6 24                     FCB     $24
09B7 0D 06                  FDB     TYPE2
09B9 42                     FCC     'BIT'
09BA 49
09BB 54
09BC 85                     FCB     $85
09BD 0D 51                  FDB     TYPE5
09BF 42                     FCC     'BLE'
09C0 4C
09C1 45
09C2 2F                     FCB     $2F
09C3 0D 06                  FDB     TYPE2
09C5 42                     FCC     'BLO'
09C6 4C
09C7 4F
09C8 25                     FCB     $25
09C9 0D 06                  FDB     TYPE2
09CB 42                     FCC     'BLS'
```

```
LOCN B1 B2 B3
09CC 4C
09CD 53
09CE 23                 FCB     $23
09CF 0D 06              FDB     TYPE2
09D1 42                 FCC     'BLT'
09D2 4C
09D3 54
09D4 2D                 FCB     $2D
09D5 0D 06              FDB     TYPE2
09D7 42                 FCC     'BMI'
09D8 4D
09D9 49
09DA 2B                 FCB     $2B
09DB 0D 06              FDB     TYPE2
09DD 42                 FCC     'BNE'
09DE 4E
09DF 45
09E0 26                 FCB     $26
09E1 0D 06              FDB     TYPE2
09E3 42                 FCC     'BPL'
09E4 50
09E5 4C
09E6 2A                 FCB     $2A
09E7 0D 06              FDB     TYPE2
09E9 42                 FCC     'BRA'
09EA 52
09EB 41
09EC 20                 FCB     $20
09ED 0D 06              FDB     TYPE2
09EF 42                 FCC     'BSR'
09F0 53
09F1 52
09F2 8D                 FCB     $8D
09F3 0D 06              FDB     TYPE2
09F5 42                 FCC     'BVC'
09F6 56
09F7 43
09F8 28                 FCB     $28
09F9 0D 06              FDB     TYPE2
09FB 42                 FCC     'BVS'
09FC 56
09FD 53
09FE 29                 FCB     $29
09FF 0D 06              FDB     TYPE2
0A01 43                 FCC     'CBA'
0A02 42
0A03 41
0A04 11                 FCB     $11
0A05 0D 03              FDB     TYPE1
0A07 43                 FCC     'CLC'
0A08 4C
0A09 43
0A0A 0C                 FCB     $0C
0A0B 0D 03              FDB     TYPE1
0A0D 43                 FCC     'CLI'
```

```
LOCN B1 B2 B3
0A0E 4C
0A0F 49
0A10 0E                  FCB    $0E
0A11 0D 03               FDB    TYPE1
0A13 43                  FCC    'CLR'
0A14 4C
0A15 52
0A16 4F                  FCB    $4F
0A17 0D 7B               FDB    TYPE6
0A19 43                  FCC    'CLV'
0A1A 4C
0A1B 56
0A1C 0A                  FCB    $0A
0A1D 0D 03               FDB    TYPE1
0A1F 43                  FCC    'CMP'
0A20 4D
0A21 50
0A22 81                  FCB    $81
0A23 0D 51               FDB    TYPE5
0A25 43                  FCC    'COM'
0A26 4F
0A27 4D
0A28 43                  FCB    $43
0A29 0D 7B               FDB    TYPE6
0A2B 43                  FCC    'CPX'
0A2C 50
0A2D 58
0A2E 8C                  FCB    $8C
0A2F 0D 51               FDB    TYPE5
0A31 44                  FCC    'DAA'
0A32 41
0A33 41
0A34 19                  FCB    $19
0A35 0D 03               FDB    TYPE1
0A37 44                  FCC    'DEC'
0A38 45
0A39 43
0A3A 4A                  FCB    $4A
0A3B 0D 7B               FDB    TYPE6
0A3D 44                  FCC    'DES'
0A3E 45
0A3F 53
0A40 34                  FCB    $34
0A41 0D 03               FDB    TYPE1
0A43 44                  FCC    'DEX'
0A44 45
0A45 58
0A46 09                  FCB    $09
0A47 0D 03               FDB    TYPE1
0A49 45                  FCC    'END'
0A4A 4E
0A4B 44
0A4C 00                  FCB    00
0A4D 10 DD               FDB    TYPE16
0A4F 45                  FCC    'EOR'
```

```
LOCN B1 B2 B3
0A50 4F
0A51 52
0A52 88                 FCB     $88
0A53 0D 51              FDB     TYPE5
0A55 45                 FCC     'EQU'
0A56 51
0A57 55
0A58 00                 FCB     0
0A59 10 B0              FDB     TYPE15
0A5B 46                 FCC     'FCB'
0A5C 43
0A5D 42
0A5E 00                 FCB     0
0A5F 0F 42              FDB     TYPE9
0A61 46                 FCC     'FCC'
0A62 43
0A63 43
0A64 00                 FCB     0
0A65 0E 87              FDB     TYPE8
0A67 46                 FCC     'FDB'
0A68 44
0A69 42
0A6A 00                 FCB     0
0A6B 0F 7E              FDB     TYPE10
0A6D 49                 FCC     'INC'
0A6E 4E
0A6F 43
0A70 4C                 FCB     $4C
0A71 0D 7B              FDB     TYPE6
0A73 49                 FCC     'INS'
0A74 4E
0A75 53
0A76 31                 FCB     $31
0A77 0D 03              FDB     TYPE1
0A79 49                 FCC     'INX'
0A7A 4E
0A7B 58
0A7C 08                 FCB     $08
0A7D 0D 03              FDB     TYPE1
0A7F 4A                 FCC     'JMP'
0A80 4D
0A81 50
0A82 6E                 FCB     $6E
0A83 0D 35              FDB     TYPE3
0A85 4A                 FCC     'JSR'
0A86 53
0A87 52
0A88 AD                 FCB     $AD
0A89 0D 35              FDB     TYPE3
0A8B 4C                 FCC     'LDA'
0A8C 44
0A8D 41
0A8E 86                 FCB     $86
0A8F 0D 51              FDB     TYPE5
0A91 4C                 FCC     'LDS'
```

```
LOCN B1 B2 B3
0A92 44
0A93 53
0A94 8E                  FCB    $8E
0A95 0D 51               FDB    TYPE5
0A97 4C                  FCC    'LDX'
0A98 44
0A99 58
0A9A CE                  FCB    $CE
0A9B 0D 51               FDB    TYPE5
0A9D 4C                  FCC    'LSR'
0A9E 53
0A9F 52
0AA0 44                  FCB    $44
0AA1 0D 7B               FDB    TYPE6
0AA3 4D                  FCC    'MON'
0AA4 4F
0AA5 4E
0AA6 00                  FCB    0
0AA7 10 DD               FDB    TYPE16
0AA9 4E                  FCC    'NAM'
0AAA 41
0AAB 4D
0AAC 00                  FCB    0
0AAD 10 E9               FDB    TYPE17
0AAF 4E                  FCC    'NEG'
0AB0 45
0AB1 47
0AB2 40                  FCB    $40
0AB3 0D 7B               FDB    TYPE6
0AB5 4E                  FCC    'NOP'
0AB6 4F
0AB7 50
0AB8 01                  FCB    01
0AB9 0D 03               FDB    TYPE1
0ABB 4F                  FCC    'OPT'
0ABC 50
0ABD 54
0ABE 00                  FCB    0
0ABF 0F ED               FDB    TYPE12
0AC1 4F                  FCC    'ORA'
0AC2 52
0AC3 41
0AC4 8A                  FCB    $8A
0AC5 0D 51               FDB    TYPE5
0AC7 4F                  FCC    'ORG'
0AC8 52
0AC9 47
0ACA 00                  FCB    0
0ACB 10 A2               FDB    TYPE14
0ACD 50                  FCC    'PAG'
0ACE 41
0ACF 47
0AD0 00                  FCB    0
0AD1 10 89               FDB    TYPE13
0AD3 50                  FCC    'PSH'
```

```
LOCN B1 B2 B3
0AD4 53
0AD5 48
0AD6 36                 FCB     $36
0AD7 0D 88              FDB     TYPE7
0AD9 50                 FCC     'PUL'
0ADA 55
0ADB 4C
0ADC 32                 FCB     $32
0ADD 0D 88              FDB     TYPE7
0ADF 52                 FCC     'RMB'
0AE0 4D
0AE1 42
0AE2 00                 FCB     0
0AE3 11 1F              FDB     TYPE18
0AE5 52                 FCC     'ROL'
0AE6 4F
0AE7 4C
0AE8 49                 FCB     $49
0AE9 0D 7B              FDB     TYPE6
0AEB 52                 FCC     'ROR'
0AEC 4F
0AED 52
0AEE 46                 FCB     $46
0AEF 0D 7B              FDB     TYPE6
0AF1 52                 FCC     'RTI'
0AF2 54
0AF3 49
0AF4 3B                 FCB     $3B
0AF5 0D 03              FDB     TYPE1
0AF7 52                 FCC     'RTS'
0AF8 54
0AF9 53
0AFA 39                 FCB     $39
0AFB 0D 03              FDB     TYPE1
0AFD 53                 FCC     'SBA'
0AFE 42
0AFF 41
0B00 10                 FCB     $10
0B01 0D 03              FDB     TYPE1
0B03 53                 FCC     'SBC'
0B04 42
0B05 43
0B06 82                 FCB     $82
0B07 0D 51              FDB     TYPE5
0B09 53                 FCC     'SEC'
0B0A 45
0B0B 43
0B0C 0D                 FCB     $0D
0B0D 0D 03              FDB     TYPE1
0B0F 53                 FCC     'SEI'
0B10 45
0B11 49
0B12 0F                 FCB     $0F
0B13 0D 03              FDB     TYPE1
0B15 53                 FCC     'SEV'
```

```
LOCN B1 B2 B3
0B16 45
0B17 56
0B18 0B                 FCB     $0B
0B19 0D 03              FDB     TYPE1
0B1B 53                 FCC     'SPC'
0B1C 50
0B1D 43
0B1E 00                 FCB     0
0B1F 0F BD              FDB     TYPE11
0B21 53                 FCC     'STA'
0B22 54
0B23 41
0B24 97                 FCB     $97
0B25 0D 54              FDB     TYPE4
0B27 53                 FCC     'STS'
0B28 54
0B29 53
0B2A 9F                 FCB     $9F
0B2B 0D 54              FDB     TYPE4
0B2D 53                 FCC     'STX'
0B2E 54
0B2F 58
0B30 DF                 FCB     $DF
0B31 0D 54              FDB     TYPE4
0B33 53                 FCC     'SUB'
0B34 55
0B35 42
0B36 80                 FCB     $80
0B37 0D 51              FDB     TYPE5
0B39 53                 FCC     'SWI'
0B3A 57
0B3B 49
0B3C 3F                 FCB     $3F
0B3D 0D 03              FDB     TYPE1
0B3F 54                 FCC     'TAB'
0B40 41
0B41 42
0B42 16                 FCB     $16
0B43 0D 03              FDB     TYPE1
0B45 54                 FCC     'TAP'
0B46 41
0B47 50
0B48 06                 FCB     $06
0B49 0D 03              FDB     TYPE1
0B4B 54                 FCC     'TBA'
0B4C 42
0B4D 41
0B4E 17                 FCB     $17
0B4F 0D 03              FDB     TYPE1
0B51 54                 FCC     'TPA'
0B52 50
0B53 41
0B54 07                 FCB     $07
0B55 0D 03              FDB     TYPE1
0B57 54                 FCC     'TST'
```

```
LOCN B1 B2 B3
0B58 53
0B59 54
0B5A 4D                    FCB     $4D
0B5B 0D 7B                 FDB     TYPE6
0B5D 54                    FCC     'TSX'
0B5E 53
0B5F 58
0B60 30                    FCB     $30
0B61 0D 03                 FDB     TYPE1
0B63 54                    FCC     'TTL'
0B64 54
0B65 4C
0B66 00                    FCB     0
0B67 10 E9                 FDB     TYPE17
0B69 54                    FCC     'TXS'
0B6A 58
0B6B 53
0B6C 35                    FCB     $35
0B6D 0D 03                 FDB     TYPE1
0B6F 57           OPTEND   FCC     'WAI'
0B70 41
0B71 49
0B72 3E                    FCB     $3E
0B73 0D 03                 FDB     TYPE1
                  ** PARSE
                  * PARSE A LINE OF SOURCE INTO POINTERS
                  * AND CHECK SYNTAX
0B75 96 48        PARSE    LDA A   LINBYT
0B77 08           PARSOA   INX
0B78 4A                    DEC A
0B79 2A FC                 BPL     PARSOA
0B7B DF 7B                 STX     QTEMP
0B7D DF 8D                 STX     LINPTR     SAVE PRINT POSITION
0B7F 86 FF        PARSE0   LDA A   #$FF
0B81 97 55                 STA A   PRFLG      SET PROCESS FLAG
0B83 97 5E                 STA A   PRTFLG
0B85 97 5F                 STA A   PAGFLG
0B87 BD 0C 65              JSR     CLRLAB     GO CLEAR LABEL STORE
0B8A 4F                    CLR A
0B8B 97 90                 STA A   OPCNT      SET OP COUNT =0
0B8D 97 AB                 STA A   MODFY      SET FLAG
0B8F 97 7D                 STA A   TEMP
0B91 97 59                 STA A   PCFLAG
0B93 97 81                 STA A   P2ERR1
0B95 97 82                 STA A   P2ERR2
0B97 97 83                 STA A   P2ERR3
0B99 97 56                 STA A   ERRFLG
0B9B DF 94                 STX     OPTPTR
0B9D DF 96                 STX     OPNPTR
0B9F DE 7B                 LDX     QTEMP
0BA1 A6 00                 LDA A   0,X        GET FIRST CHAR
0BA3 81 0D                 CMP A   #$D        CHECK FOR EMPTY
0BA5 26 03                 BNE     CHKCOM
0BA7 7E 0C 2D              JMP     PARSE3
0BAA 81 2A        CHKCOM   CMP A   #'*       CHECK FOR COMMEMT
```

```
LOCN B1 B2 B3
0BAC 27 78          BEQ    FINDCR
0BAE 81 20    PARSE1 CMP A  #' 
0BB0 27 22          BEQ    PARSE2
0BB2 97 59          STA A  PCFLAG
0BB4 81 41          CMP A  #'A      CHECK FOR LETTER A
0BB6 25 04          BCS    LABERR
0BB8 81 5A          CMP A  #'Z      CHECK FOR Z
0BBA 23 07          BLS    PARS1A
0BBC 86 04    LABERR LDA A  #4       SET ERROR
0BBE BD 07 E5       JSR    ASMERR
0BC1 20 0E          BRA    PARS1B   FINISH LINE
0BC3 BD 0C 8F PARS1A JSR   COPLBL   GO COPY THE LABEL
0BC6 4D             TST A
0BC7 26 08          BNE    PARS1B
0BC9 C1 0D          CMP B  #$D      CHECK FOR CR
0BCB 27 60          BEQ    PARSE3
0BCD C1 20          CMP B  #' 
0BCF 26 EB          BNE    LABERR
0BD1 BD 0C 50 PARS1B JSR   FINDS2   GO FIND A SPACE
0BD4 BD 0C 5C PARSE2 JSR   NXTBL2   GO GET NEXT TOKEN
0BD7 27 54          BEQ    PARSE3   IF Z, NO OPERATION
0BD9 5F             CLR B
0BDA D7 55          STA B  PRFLG    SET PROCESS FLAG
0BDC 86 FF          LDA A  #$FF
0BDE 97 59          STA A  PCFLAG
0BE0 DF 94          STX    OPTPTR   SAVE OPERATION POINTER
0BE2 08             INX
0BE3 A6 00          LDA A  0,X
0BE5 81 0D          CMP A  #$D
0BE7 27 16          BEQ    PARS2F
0BE9 08             INX
0BEA A6 00          LDA A  0,X
0BEC 81 0D          CMP A  #$D
0BEE 27 0F          BEQ    PARS2F
0BF0 20 12          BRA    PARS2A
0BF2 96 8F    PEVAL LDA A  PASS
0BF4 4A             DEC A
0BF5 97 56          STA A  ERRFLG
0BF7 BD 11 D5       JSR    EVAL     GO EVALUATE
0BFA 7F 00 56       CLR    ERRFLG
0BFD 39             RTS              RETURN
0BFE 02             NOP              SPACE
0BFF 86 03    PARS2F LDA A  #$03
0C01 20 48          BRA    PARFF2
0C03 02             NOP              SPACE
0C04 8D 55    PARS2A BSR    NXTBLK
0C06 27 25          BEQ    PARSE3
0C08 81 41          CMP A  #'A      IS IT AN A?
0C0A 27 05          BEQ    PARS2D
0C0C 81 42          CMP A  #'B      IS IT A B?
0C0E 26 14          BNE    PARS2E
0C10 5C       PARS2B INC B
0C11 5C       PARS2D INC B
0C12 08             INX
0C13 A6 00          LDA A  0,X      GET CHAR
```

```
LOCN B1 B2 B3
0C15 81 0D          CMP A  #$D
0C17 27 20          BEQ    PARSE4
0C19 81 20          CMP A  #'          IS IT A SPACE?
0C1B 27 1F          BEQ    PARS2H
0C1D 09       PARS2J DEX
0C1E 20 04          BRA    PARS2E
0C20                RMB    4
0C24 DF 96    PARS2E STX    OPNPTR
0C26 08       FINDCR INX               BUMP POINTER
0C27 A6 00          LDA A  0,X         GET CHAR
0C29 81 0D          CMP A  #$D         IS IT A CR
0C2B 26 F9          BNE    FINDCR      IF NOT, GET NEXT
0C2D 96 7D    PARSE3 LDA A  TEMP
0C2F 27 07          BEQ    PARSE5
0C31 DF 7B          STX    QTEMP
0C33 BD 07 D6 PARSE7 JSR    OPSERR
0C36 DE 7B    PARSE6 LDX    QTEMP
0C38 39       PARSE5 RTS
0C39 D7 AB    PARSE4 STA B  MODFY
0C3B 39              RTS                DONE
0C3C D7 AB    PARS2H STA B  MODFY       SAVE
0C3E 8D 1C          BSR    NXTBL2      GET NEXT
0C40 27 EB          BEQ    PARSE3
0C42 20 E0          BRA    PARS2E
0C44 DE 4B    FND222 LDX    PC          GET PC
0C46 DF 6D          STX    XTEMP2      SAVE IT
0C48 7E 09 1F       JMP    FNDOPT
0C4B 97 7D    PARFF2 STA A  TEMP
0C4D 20 D7          BRA    FINDCR      GO LOCATE CR
0C4F 08       FINDSP INX               BUMP POINTER
0C50 A6 00    FINDS2 LDA A  0,X         GET THE CHAR
0C52 81 0D          CMP A  #$D         CHECK FOR CR
0C54 27 0E          BEQ    NXTBL3
0C56 81 20          CMP A  #'          IS IT A SPACE?
0C58 26 F5          BNE    FINDSP      IF NOT, GET NEXT
0C5A 39             RTS                DONE
0C5B 08       NXTBLK INX               BUMP POINTER
0C5C A6 00    NXTBL2 LDA A  0,X         GET CHAR
0C5E 81 20          CMP A  #'          IS IT A SPACE?
0C60 27 F9          BEQ    NXTBLK      IF SO, GET NEXT
0C62 81 0D          CMP A  #$D         IS IT A CR
0C64 39       NXTBL3 RTS               DONE


              *
              ** CLRLAB
              * CLEAR LABEL STORAGE
0C65 CE 00 20 CLRLAB LDX    #$0020
0C68 DF 4F           STX    LABEL
0C6A CE 20 20        LDX    #$2020
0C6D DF 51           STX    LABEL+2
0C6F DF 53           STX    LABEL+4    SET EM
0C71 39              RTS
              *
              *
```

```
LOCN B1 B2 B3
                    *
                    ** ADDPCN
                    * INCREMENT PC N TIMES
                    * SET OPERAND (BYTE) COUNT
0C72 DE 4B          ADDPC3  LDX     PC          GET THE PC
0C74 08                     INX
0C75 08                     INX                 BUMP TWICE
0C76 7C 00 90               INC     OPCNT
0C79 7C 00 90               INC     OPCNT       KICK OPERAND COUNT
0C7C 20 0A                  BRA     ADDPC0
0C7E DE 4B          ADDPC2  LDX     PC          GET THE PC
0C80 08                     INX                 BUMP IT
0C81 7C 00 90               INC     OPCNT
0C84 20 02                  BRA     ADDPC0
0C86 DE 4B          ADDPC1  LDX     PC
0C88 08             ADDPC0  INX                 BUMP IT
0C89 DF 4B                  STX     PC          PUT BACK
0C8B 7C 00 90               INC     OPCNT
0C8E 39                     RTS                 DONE
                    *
                    ** COPLBL
                    * COPY LABEL TO LABEL STORE
0C8F 8D 1B          COPLBL  BSR     GETCHR
0C91 97 4F                  STA A   LABEL
0C93 8D 17                  BSR     GETCHR
0C95 97 50                  STA A   LABEL+1
0C97 8D 13                  BSR     GETCHR
0C99 97 51                  STA A   LABEL+2
0C9B 8D 0F                  BSR     GETCHR
0C9D 97 52                  STA A   LABEL+3
0C9F 8D 0B                  BSR     GETCHR
0CA1 97 53                  STA A   LABEL+4
0CA3 8D 07                  BSR     GETCHR
0CA5 97 54                  STA A   LABEL+5
0CA7 39                     RTS                 RETURN
0CA8 08             COPDON  INX
0CA9 39                     RTS
                    *
0CAA                        RMB     2
                    *
                    *
                    ** GETCHR
                    * GET A CHARACTER
0CAC A6 00          GETCHR  LDA A   0,X
0CAE 84 7F                  AND A   #$7F        MASK  PARITY
0CB0 16                     TAB
0CB1 81 30                  CMP A   #'0
0CB3 25 0C                  BCS     FIX         IF <0, FIX STACK
0CB5 81 39                  CMP A   #'9
0CB7 23 EF                  BLS     COPDON      IF <=9, OK
0CB9 81 41                  CMP A   #'A
0CBB 25 04                  BCS     FIX         IF <A, FIX STACK
0CBD 81 5A                  CMP A   #'Z
0CBF 23 E7                  BLS     COPDON      IF <=Z, OK
0CC1 31             FIX     INS
```

```
LOCN B1 B2 B3
0CC2 31              INS              FIX STACK
0CC3 4F              CLR A            SET A
0CC4 39              RTS              DONE
                     *
                     ** OUT3S
                     * PRINT 3 SPACES
0CC5 8D 02           OUT3S   BSR      OUTSZ
0CC7 8D 00           OUT2S   BSR      OUTSZ
0CC9 7E 03 1E        OUTSZ   JMP      OUTS        PRINT A SPACE
                     *
                     ** OUTHXS
                     * PRINT 2 HEX DIGITS AND A SPACE
0CCC 8D 02           OUTHXS  BSR      OUTHEX      GO PRINT DIGITS
0CCE 20 F9           BRA      OUTSZ
                     *
                     ** OUTHEX
                     * PRINT A AS 2 HEX DIGITS
0CD0 36              OUTHEX  PSH A                SAVE
0CD1 8D 08           BSR      HEXL        GO CONVERT
0CD3 8D 03           BSR      PRTIT       GO PRINT IT
0CD5 32              PUL A
0CD6 8D 07           BSR      HEXR        GO CONVERT
0CD8 7E 03 20        PRTIT   JMP      OUTCH       GO PRINT
                     *
0CDB 44              HEXL    LSR A
0CDC 44              LSR A
0CDD 44              LSR A
0CDE 44              LSR A
                     *
0CDF 84 0F           HEXR    AND A    #$F         MASK DOWN
0CE1 8B 90           ADD A    #$90
0CE3 19              DAA
0CE4 89 40           ADC A    #$40
0CE6 19              DAA
0CE7 39              RTS              TRICK CONVERT
                     *
                     ** SUB16
                     * 16 BIT SUBTRACT
0CE8 97 7D           SUB16   STA A    TEMP        SAVE
0CEA A6 01           LDA A    1,X
0CEC 10              SBA
0CED A7 01           STA A    1,X
0CEF A6 00           LDA A    0,X
0CF1 92 7D           SBC A    TEMP
0CF3 A7 00           STA A    0,X
0CF5 49              ROL A
0CF6 88 01           EOR A    #1
0CF8 46              ROR A            SET ARITH CARRY
0CF9 39              RTS
                     *
                     ** ADD16
                     * 16 BIT ADD
0CFA EB 01           ADD16   ADD B    1,X         ADD ON
0CFC A9 00           ADC A    0,X         ADD WITH CARRY (MS)
0CFE A7 00           STA A    0,X         SAVE
```

```
LOCN B1 B2 B3
0D00 E7 01              STA B  1,X       SAVE LS
0D02 39                 RTS
                    *
                    ** TYPE1
                    * HANDLES TYPE1 INSTRUCTIONS
0D03 7E 0C 86       TYPE1   JMP    ADDPC1    GO FIX PC
                    *
                    ** TYPE2
                    * HANDLES TYPE2 INSTRUCTIONS
0D06 96 AB          TYPE2   LDA A  MODFY     CHECK MODIFY FLAG
0D08 26 42              BNE    TYP3R
0D0A BD 0C 7E           JSR    ADDPC2
0D0D 96 8F              LDA A  PASS      CHECK PASS COUNT
0D0F 27 23              BEQ    TYPE2D    IF PASS 1, SKIP
0D11 BD 11 D5           JSR    EVAL      GO EVALUATE OPERAND
0D14 26 16              BNE    TYPE2B    IF EVAL ERROR, UNDEFINED
0D16 96 4B              LDA A  PC
0D18 D6 4C              LDA B  PC+1      REFERENCE ADDRESS
0D1A CE 00 7B           LDX    #QTEMP    POINT
0D1D BD 0C E8           JSR    SUB16     GO SUBTRACT
0D20 4F                 CLR A
0D21 D6 7C              LDA B  QTEMP+1   GET LS RESULT
0D23 D7 7F              STA B  OP1       SAVE BRANCH AMOUNT
0D25 2A 01              BPL    TYPE2A    IF POS, SKIP
0D27 43                 COM A            COMPLEMENT A
0D28 91 7B          TYPE2A  CMP A  QTEMP     CHECK SIGN EXTENSION
0D2A 27 08              BEQ    TYPE2D    IF EQUAL, OK
0D2C 7F 00 7F       TYPE2B  CLR    OP1       SET BRANCH = 0
0D2F 86 06              LDA A  #6
0D31 7E 07 E5           JMP    ASMERR    GO REPORT ERROR
0D34 39             TYPE2D  RTS              DONE
                    *
                    ** TYPE3
                    * HANDLES TYPE3 INST.
0D35 96 AB          TYPE3   LDA A  MODFY     GET MODIFIER
0D37 26 13              BNE    TYP3R     IF SET, ERROR
0D39 BD 0D A3       TYPE3A  JSR    INDEX     GO CHECK INDEXED
                    *
                    ** EXTEND
                    * CHECKS FOR EXTENDED ADDRESSING (DEFAULT)
0D3C 96 8F          EXTEND  LDA A  PASS
0D3E 27 09              BEQ    EXTEN1    CHECK PASS=1
0D40 BD 11 D5           JSR    EVAL      GO EVALUATE OPERAND
0D43 DE 7B          EXTEN0  LDX    QTEMP     GET RESULT
0D45 DF 7F              STX    OP1       SET BYTES 2,3
0D47 8D 13              BSR    FIXMOD
0D49 7E 0C 72       EXTEN1  JMP    ADDPC3    KICK PC AGAIN
0D4C 86 03          TYP3R   LDA A  #3
0D4E 7E 07 D6           JMP    OPSERR
                    *
                    ** TYPE5
                    * HANDLE TYPE5 INST.
0D51 BD 0E 3F       TYPE5   JSR    IMMED     CHECK IMMEDIATE
                    *
                    ** TYPE4
```

```
LOCN B1 B2 B3
                    * HANDLE TYPE4 INST.
0D54 BD 0E 04       TYPE4   JSR     DIRECT      GO CHECK DIRECT
0D57 20 E0                  BRA     TYPE3A      DEFAULT EXTEND
                    *
                    ** FIXMOD
                    * SET UP MODIFIER
0D59 8D 01          TFIXMD  BSR     FIXMOD
0D5B 39                     RTS
0D5C D6 7E          FIXMOD  LDA B   OPCODE
0D5E C1 80                  CMP B   #$80
0D60 24 05                  BCC     FIXM3       CHECK NO MODIFIER
0D62 96 AB          FIXM4   LDA A   MODFY
0D64 26 36                  BNE     TYPE7C      CHECK ILLEGAL
0D66 39                     RTS
0D67 C4 0F          FIXM3   AND B   #$F
0D69 C1 0B                  CMP B   #$B         CHECK NO MODIFIER
0D6B 22 F5                  BHI     FIXM4
0D6D 96 AB          FIXM5   LDA A   MODFY       GET MODIFIER
0D6F 27 2B                  BEQ     TYPE7C
0D71 4A                     DEC A
0D72 40                     NEG A
0D73 84 40                  AND A   #$40
0D75 9B 7E                  ADD A   OPCODE
0D77 97 7E                  STA A   OPCODE      FIX UP OPCODE
0D79 4F                     CLR A               RESET ERROR
0D7A 39                     RTS
                    *
                    ** TYPE6
                    * HANDLE TYPE6 INST.
0D7B 96 AB          TYPE6   LDA A   MODFY       GET MODIFIER
0D7D 4A                     DEC A
0D7E 2A 0D                  BPL     TYPE7A      CHECK INHERENT (A,B)
0D80 D6 7E                  LDA B   OPCODE      GET OPCODE
0D82 CB 20                  ADD B   #$20        ADD ON
0D84 D7 7E                  STA B   OPCODE      PUT BACK
0D86 20 B1                  BRA     TYPE3A      GO DO TYPE3
                    *
                    ** TYPE7
                    * HANDLE TYPE7 INSTRUCTIONS
0D88 96 AB          TYPE7   LDA A   MODFY       GET MODIFIER
0D8A 4A                     DEC A
0D8B 2B BF,                 BMI     TYP3R
0D8D D6 7E          TYPE7A  LDA B   OPCODE      GET CODE
0D8F C1 3F                  CMP B   #$3F        CHECK PUSH OR PULL
0D91 23 03                  BLS     TYPE7D
0D93 40                     NEG A
0D94 84 10                  AND A   #$10        MASK DOWN
0D96 1B             TYPE7D  ABA                 MODIFY
0D97 97 7E                  STA A   OPCODE      SAVE
0D99 7E 0C 86               JMP     ADDPC1      KICK PC
0D9C 31             TYPE7C  INS
0D9D 31                     INS
0D9E 86 03                  LDA A   #3
0DA0 7E 07 D6               JMP     OPSERR
                    *
```

```
LOCN B1 B2 B3
                    ** INDEX
                    * CHECK FOR INDEX ADDRESSING
                    * RETURN IF NOT
0DA3 DE 6B      INDEX   LDX     XTEMP1      GET OPERAND PTR
0DA5 7F 00 7F           CLR     OP1
0DA8 A6 00              LDA A   0,X         FIRST CHAR
0DAA 81 58              CMP A   #'X         IS IT AN X?
0DAC 26 0C              BNE     INDEX1      IF NOT, CHECK NEXT
0DAE A6 01              LDA A   1,X
0DB0 81 20              CMP A   #'
0DB2 27 22              BEQ     INDEX3
0DB4 81 0D              CMP A   #$D
0DB6 26 02              BNE     INDEX1
0DB8 20 1C              BRA     INDEX3
0DBA A6 00      INDEX1  LDA A   0,X         GET CHAR
0DBC 81 2C              CMP A   #',         CHECK FOR COMMA
0DBE 27 20              BEQ     INDEX4
0DC0 81 20              CMP A   #'          CHECK FOR SPACE
0DC2 27 2F              BEQ     INDEX0      IF SO, EXTENDED
0DC4 81 0D              CMP A   #$D
0DC6 27 2B              BEQ     INDEX0
0DC8 08                 INX
0DC9 20 EF              BRA     INDEX1
0DCB 96 8F      INDEX2  LDA A   PASS
0DCD 27 07              BEQ     INDEX3      CHECK PASS COUNT
0DCF BD 11 D5           JSR     EVAL        GO EVALUATE
0DD2 96 7C              LDA A   QTEMP+1
0DD4 97 7F              STA A   OP1         SET OFFSET
0DD6 BD 0D 59   INDEX3  JSR     TFIXMD
0DD9 26 26              BNE     FIXXX2
0DDB 31                 INS
0DDC 31                 INS                 FIX STAC
0DDD 7E 0C 7E           JMP     ADDPC2
0DE0 A6 01      INDEX4  LDA A   1,X         GET NEXT CHAR
0DE2 81 58              CMP A   #'X         IS IT X
0DE4 26 14              BNE     INDEX5      IF NOT, EXTENDED
0DE6 08                 INX
0DE7 A6 01      INDE00  LDA A   1,X         GET FOLLOWING
0DE9 81 20              CMP A   #'          MUST BE SPACE
0DEB 27 DE              BEQ     INDEX2      IF SO, INDEXED
0DED 81 0D              CMP A   #$D
0DEF 27 DA              BEQ     INDEX2
0DF1 20 07              BRA     INDEX5
0DF3 D6 7E      INDEX0  LDA B   OPCODE
0DF5 CB 10              ADD B   #$10
0DF7 D7 7E              STA B   OPCODE
0DF9 39         INDEX9  RTS
0DFA 86 08      INDEX5  LDA A   #8
0DFC 31                 INS
0DFD 31                 INS
0DFE 7E 07 D6           JMP     OPSERR      GO REPORT ERROR
0E01 31         FIXXX2  INS
0E02 31                 INS                 FIX STACK
0E03 39                 RTS                 DONE
                    *
```

```
LOCN B1 B2 B3
                    ** DIRECT
                    * CHECK FOR DIRECT ADDRESSING
0E04 DE 6B          DIRECT  LDX     XTEMP1
0E06 86 FF                  LDA A   #$FF
0E08 97 56                  STA A   ERRFLG      DISABLE ERRORS
0E0A 97 60                  STA A   LBLMSK      SET MASK
0E0C DF 73                  STX     XTEMP5      SAVE POINTER
0E0E BD 11 D5               JSR     EVAL        GO CALCULATE
0E11 7F 00 56               CLR     ERRFLG      ENABLE ERRORS
0E14 C6 7F                  LDA B   #$7F
0E16 D7 60                  STA B   LBLMSK      RESET MASK
0E18 DE 6B                  LDX     XTEMP1      GET END PTR
0E1A E6 00                  LDA B   0,X         GET TERMINATOR
0E1C C1 2C                  CMP B   #',         CHECK  INDEXED
0E1E 36                     PSH A
0E1F 07                     TPA
0E20 DE 73                  LDX     XTEMP5
0E22 DF 6B                  STX     XTEMP1
0E24 33                     PUL B
0E25 06                     TAP                 RESET CCR
0E26 27 10                  BEQ     NDIR
0E28 5D                     TST B
0E29 26 0D                  BNE     NDIR        IF NO FIND ALL, NO DIRECT
0E2B D6 7B                  LDA B   QTEMP       GET MS BYTE
0E2D 26 09                  BNE     NDIR
0E2F BD 0D 59               JSR     TFIXMD
0E32 26 50                  BNE     FIXXX
0E34 96 7C                  LDA A   QTEMP+1
0E36 20 2F                  BRA     IMMED2
0E38 D6 7E          NDIR    LDA B   OPCODE
0E3A CB 10                  ADD B   #$10
0E3C D7 7E                  STA B   OPCODE
0E3E 39                     RTS                 PASS ON
                    *
                    ** IMMED
                    * CHECK FOR IMMEDIATE ADDRESSING
0E3F DE 6B          IMMED   LDX     XTEMP1      GET OPERAND PTR
0E41 A6 00                  LDA A   0,X
0E43 81 23                  CMP A   #'#         CHECK FOR #
0E45 27 07                  BEQ     IMMED1      IF SO, IMMEDIATE
0E47 D6 7E          IMMED0  LDA B   OPCODE
0E49 CB 10                  ADD B   #$10
0E4B D7 7E                  STA B   OPCODE
0E4D 39                     RTS
0E4E 08             IMMED1  INX
0E4F DF 6B                  STX     XTEMP1      MOVE PAST #
0E51 D6 7E                  LDA B   OPCODE
0E53 C4 0F                  AND B   #$F
0E55 C1 0B                  CMP B   #$B
0E57 22 15                  BHI     IMMED3
0E59 BD 0D 59               JSR     TFIXMD
0E5C 26 26                  BNE     FIXXX
0E5E 96 8F                  LDA A   PASS
0E60 27 07                  BEQ     IMMED4      IF PASS1, SKIP
0E62 BD 11 D5               JSR     EVAL        GO EVALUATE OPERAND
```

```
LOCN B1 B2 B3
0E65 96 7C          LDA A  QTEMP+1   GET LS RESULT
0E67 97 7F    IMMED2 STA A  OP1      SET BYTE 2
0E69 BD 0C 7E IMMED4 JSR    ADDPC2
0E6C 20 16           BRA    FIXXX
0E6E 96 AB    IMMED3 LDA A  MODFY
0E70 4A              DEC A
0E71 2B 03           BMI    IMMED5
0E73 7E 0D 9C IMMED6 JMP    TYPE7C
0E76 BD 0C 72 IMMED5 JSR    ADDPC3
0E79 96 8F           LDA A  PASS
0E7B 27 07           BEQ    FIXXX    CHECK PASS COUNT
0E7D BD 11 D5        JSR    EVAL     GO EVALUATE
0E80 DE 7B           LDX    QTEMP    GET ARG
0E82 DF 7F           STX    OP1      SET OPERANDS
0E84 31       FIXXX  INS
0E85 31              INS
0E86 39              RTS
                     *
                     ** TYPE8
                     *
0E87 86 FF    TYPE8  LDA A  #$FF
0E89 97 56           STA A  ERRFLG   SUPPRESS ERROR REPORT
0E8B DE 96           LDX    OPNPTR
0E8D DF 73           STX    XTEMP5   SAVE START
0E8F BD 11 D5        JSR    EVAL     GO EVALUATE EXPR
0E92 CE 02 00        LDX    #BYTSTK
0E95 DF 87           STX    BYTPTR   SET UP POINTER
0E97 96 7C           LDA A  QTEMP+1  GET RESULT
0E99 27 56           BEQ    TYPE8F   IF ZERO, DELIM TYPE
0E9B DE 6B           LDX    XTEMP1
0E9D A6 00           LDA A  0,X
0E9F 81 2C           CMP A  #',
0EA1 26 4E           BNE    TYPE8F   IF NOT COMMA, DELIM TYPE
0EA3 08              INX             MOVE PAST ,
0EA4 96 7C           LDA A  QTEMP+1  GET DATA
0EA6 E6 00           LDA B  0,X      GET NEXT CHAR
0EA8 08              INX
0EA9 C1 0D           CMP B  #$D      CHECK FOR CR
0EAB 26 04           BNE    TYPE8A
0EAD 97 5B           STA A  FCCFLG
0EAF C6 20           LDA B  #$20     GET SPACE
0EB1 D7 7E    TYPE8A STA B  OPCODE   STORE FIRST BYTE
0EB3 DF 71           STX    XTEMP4   SAVE PTR
0EB5 BD 0C 86        JSR    ADDPC1   KICK PC
0EB8 DE 71           LDX    XTEMP4   GET PTR BACK
0EBA 4A              DEC A           SEE IF DONE
0EBB 26 01           BNE    TYPE8B
0EBD 39              RTS
0EBE 97 5A    TYPE8B STA A  DATFLG   SET FLAG
0EC0 86 01           LDA A  #1
0EC2 97 A6           STA A  BYTCNT   SAVE BYTE COUNT
0EC4 E6 00    TYPE8E LDA B  0,X      GET CHAR
0EC6 08              INX             KICK PTR
0EC7 DF 71           STX    XTEMP4   SAVE
0EC9 7D 00 5B        TST    FCCFLG   CHECK FLAG
```

```
LOCN B1 B2 B3
0ECC 26 06           BNE    TYPE8D
0ECE C1 0D           CMP B  #$D          CHECK CR
0ED0 26 04           BNE    TYPE8C
0ED2 97 5B           STA A  FCCFLG
0ED4 C6 20      TYPE8D LDA B  #$20
0ED6 DE 87      TYPE8C LDX    BYTPTR     GET STACK PTR
0ED8 E7 00           STA B  0,X         PUT ON STACK
0EDA 08              INX
0EDB DF 87           STX    BYTPTR      SAVE NEXT POSITION
0EDD BD 0C 86        JSR    ADDPC1
0EE0 DE 71           LDX    XTEMP4      RETRIEVE PTR
0EE2 7A 00 5A        DEC    DATFLG      COUNT OFF
0EE5 26 DD           BNE    TYPE8E      LOOP TILL DONE
0EE7 86 01           LDA A  #1
0EE9 97 90           STA A  OPCNT    CORRECT OP COUNT
0EEB 97 5A           STA A  DATFLG     SET FLAG
0EED 7F 00 56        CLR    ERRFLG     CLEAR ERROR SUPPRESS
0EF0 39              RTS               DONE
                *
0EF1 DE 73      TYPE8F LDX    XTEMP5  GET START POINTER
0EF3 E6 00           LDA B  0,X         GET DELIMITER
0EF5 08              INX               MOVE PAST
0EF6 A6 00           LDA A  0,X         GET CHAR
0EF8 97 7E           STA A  OPCODE      PUT AWAY
0EFA DF 71           STX    XTEMP4
0EFC BD 0C 86        JSR    ADDPC1      KICK PC
0EFF DE 71           LDX    XTEMP4
0F01 E1 01           CMP B  1,X         CHECK END
0F03 26 01           BNE    TYPE8G
0F05 39              RTS
0F06 D7 5A      TYPE8G STA B  DATFLG     SET FLAG
0F08 86 01           LDA A  #1
0F0A 97 A6           STA A  BYTCNT      SET COUNT
0F0C 08              INX               MOVE POINTER
0F0D A6 00      TYPE8H LDA A  0,X         GET CHAR
0F0F 08              INX
0F10 DF 71           STX    XTEMP4      SAVE PTR
0F12 DE 87           LDX    BYTPTR      GET STACK PTR
0F14 11              CBA               CHECK END
0F15 27 15           BEQ    TYPE8I      IF SO, QUIT
0F17 81 0D           CMP A  #$D         CHECK FOR CR
0F19 27 11           BEQ    TYPE8I      IF SO, QUIT
0F1B A7 00           STA A  0,X         PUT ON STACK
0F1D 08              INX
0F1E DF 87           STX    BYTPTR      SAVE NEW POSITION
0F20 8C 03 00        CPX    #BYTSTK+256
0F23 27 13           BEQ    TYPE8J
0F25 BD 0C 86        JSR    ADDPC1
0F28 DE 71           LDX    XTEMP4      GET SOURCE PTR BACK
0F2A 20 E1           BRA    TYPE8H      LOOP TILL DONE
0F2C 7F 00 56   TYPE8I CLR    ERRFLG     RESET ERROR SUPPRESSION
0F2F 86 01           LDA A  #1
0F31 97 90           STA A  OPCNT       SET COUNT
0F33 39              RTS               DONE
                *
```

```
LOCN B1 B2 B3
0F34 8D 63      TYPE8K  BSR     TYP10C
0F36 20 02              BRA     TYPE8L
0F38 8D F2      TYPE8J  BSR     TYPE81
0F3A 7F 00 56   TYPE8L  CLR     ERRFLG      RESET FLAG
0F3D 86 0B              LDA A   #11         SET ERROR
0F3F 7E 07 E5           JMP     ASMERR
                *
                *
                ** TYPE9
                * HANDLES TYPE 9 INSTRUCTIONS
0F42 CE 02 00   TYPE9   LDX     #BYTSTK
0F45 DF 87              STX     BYTPTR      SET UP STACK
0F47 BD 0B F2           JSR     PEVAL       GO EVALUATE
0F4A 96 7C              LDA A   QTEMP+1     GET DATA
0F4C 97 7E              STA A   OPCODE      PUT AWAY
0F4E BD 0C 86   TYPE9C  JSR     ADDPC1      KICK PC
0F51 DE 6B              LDX     XTEMP1      GET SOURCE PTR
0F53 A6 00              LDA A   0,X
0F55 81 0D              CMP A   #$D         CHECK DONE
0F57 27 04              BEQ     TYPE9D
0F59 81 2C              CMP A   #',
0F5B 27 05              BEQ     TYPE9A
0F5D 86 01      TYPE9D  LDA A   #1
0F5F 97 90              STA A   OPCNT    CORRECT COUNT
0F61 39                 RTS
0F62 97 5A      TYPE9A  STA A   DATFLG      SET
0F64 86 01              LDA A   #1
0F66 97 A6              STA A   BYTCNT      SET COUNT
0F68 08         TYPE9B  INX                 MOVE TO NEXT ARGUMENT
0F69 DF 6B              STX     XTEMP1      SAVE PTR
0F6B BD 0B F2           JSR     PEVAL       GO CRUNCH
0F6E DE 87              LDX     BYTPTR      GET STACK
0F70 96 7C              LDA A   QTEMP+1     GET DATA
0F72 A7 00              STA A   0,X         SAVE IT
0F74 08                 INX
0F75 DF 87              STX     BYTPTR      UPDATE AND SAVE
0F77 8C 03 00           CPX     #BYTSTK+256
0F7A 27 BC              BEQ     TYPE8J
0F7C 20 D0              BRA     TYPE9C
                *
                *
                ** TYPE10
                * EVALUATE TYPE 10 INSTRUCTION
0F7E CE 02 00   TYPE10  LDX     #BYTSTK
0F81 DF 87              STX     BYTPTR      SET UP STACK
0F83 BD 0B F2           JSR     PEVAL       GO EVALUATE
0F86 DE 7B              LDX     QTEMP
0F88 DF 7E              STX     OPCODE      PUT DATA
0F8A BD 0C 7E   TYP10A  JSR     ADDPC2      KICK PC
0F8D DE 6B              LDX     XTEMP1      GET TERM PTR
0F8F A6 00              LDA A   0,X         GET TERM
0F91 81 0D              CMP A   #$D         CHECK CR
0F93 27 04              BEQ     TYP10C
0F95 81 2C              CMP A   #',
0F97 27 05              BEQ     TYP10B
```

```
LOCN B1 B2 B3
0F99 86 02      TYP10C  LDA A  #2
0F9B 97 90              STA A  OPCNT    CORRECT COUNT
0F9D 39                 RTS
0F9E 97 5A      TYP10B  STA A  DATFLG     SET MULT DATA FLAG
0FA0 86 02              LDA A  #2
0FA2 97 A6              STA A  BYTCNT     SET COUNT
0FA4 08                 INX               MOVE PAST TERM
0FA5 DF 6B              STX    XTEMP1      SET NEW INDEX
0FA7 BD 0B F2           JSR    PEVAL      GO EVALUATE NEXT
0FAA DE 87              LDX    BYTPTR     GET POINTER
0FAC 96 7B              LDA A  QTEMP
0FAE A7 00              STA A  0,X
0FB0 96 7C              LDA A  QTEMP+1
0FB2 A7 01              STA A  1,X
0FB4 08                 INX
0FB5 08                 INX               PUT DATA AND ADJUST
0FB6 DF 87              STX    BYTPTR     SAVE PTR
0FB8 8C 03 00           CPX    #BYTSTK+256
0FBB 20 CD              BRA    TYP10A     LOOP TILL DONE
                        *
0FBD 7F 00 59   TYPE11  CLR    PCFLAG     TURN PC OFF
0FC0 96 8F              LDA A  PASS
0FC2 27 25              BEQ    TYP11C     IF PASS 1 IGNORE
0FC4 96 5D              LDA A  P3FLG
0FC6 27 21              BEQ    TYP11C
0FC8 96 4F              LDA A  LABEL
0FCA 26 1E              BNE    TYPERR
0FCC 96 AE              LDA A  LIST       SEE IF LIST ON
0FCE 27 19              BEQ    TYP11C     IF NOT, IGNORE
0FD0 BD 11 D5           JSR    EVAL       CRUNCH IT
0FD3 D6 7C              LDA B  QTEMP+1    GET COUNT
0FD5 26 02              BNE    TYP11A
0FD7 C6 01              LDA B  #1         SET 1 LINE
0FD9 BD 07 BA   TYP11A  JSR    PCRLF      DO LF
0FDC 96 5C              LDA A  EJFLG      SEE IF EJECTED
0FDE 26 03              BNE    TYP11B     IF SO, QUIT
0FE0 5A                 DEC B             COUNT OFF
0FE1 26 F6              BNE    TYP11A     LOOP TILL DONE
0FE3 7F 00 5C   TYP11B  CLR    EJFLG      RESET FLAG
0FE6 7F 00 5E           CLR    PRTFLG     DON'T PRINT
0FE9 39         TYP11C  RTS               DONE
                        *
0FEA 7E 10 B4   TYPERR  JMP    TYP15A
                        *
0FED 7F 00 59   TYPE12  CLR    PCFLAG
0FF0 96 8F              LDA A  PASS
0FF2 26 F5              BNE    TYP11C
0FF4 96 4F              LDA A  LABEL
0FF6 26 F2              BNE    TYPERR
0FF8 DE 6B      TYP12D  LDX    XTEMP1     GET ARG POINTER
0FFA A6 02              LDA A  2,X
0FFC 97 7D              STA A  TEMP       SAVE
0FFE A6 00              LDA A  0,X
1000 E6 01              LDA B  1,X        GET SWITCH ID
1002 CE 10 41           LDX    #OPTLST    POINT TO LIST
```

```
LOCN B1 B2 B3
1005 A1 00      TYP12A  CMP A  0,X        SEE IF MATCH
1007 27 10              BEQ    TYP12B
1009 08         TYP12C  INX
100A 08                 INX
100B 08                 INX
100C 08                 INX
100D 08                 INX
100E 08                 INX               ADVANCE PTR
100F 8C 10 89           CPX    #OPNEND+6  SEE IF TABLE END
1012 26 F1              BNE    TYP12A     LOOP
1014 86 0A              LDA A  #10
1016 7E 07 E5           JMP    ASMERR     SET ERROR NUMBER AND REPORT
1019 E1 01      TYP12B  CMP B  1,X        SEE IF SECOND MATCH
101B 26 EC              BNE    TYP12C     IF NOT, GO BACK
101D 36                 PSH A
101E 96 7D              LDA A  TEMP       GET 3RD CHAR
1020 A1 02              CMP A  2,X        SEE IF MATCH
1022 32                 PUL A
1023 26 E4              BNE    TYP12C     IF NOT, LOOP
1025 A6 03              LDA A  3,X        GET DATA
1027 EE 04              LDX    4,X        GET ADDRESS
1029 A7 00              STA A  0,X        SET SWITCH
102B DE 6B              LDX    XTEMP1
102D A6 00      FNDEND  LDA A  0,X
102F 08                 INX
1030 DF 6B              STX    XTEMP1
1032 81 0D              CMP A  #$D
1034 27 0A              BEQ    OPTDON
1036 81 20              CMP A  #'
1038 27 06              BEQ    OPTDON
103A 81 2C              CMP A  #',
103C 27 BA              BEQ    TYP12D
103E 20 ED              BRA    FNDEND
1040 39         OPTDON  RTS               DONE
                *
1041 4C         OPTLST  FCC    'LIS'
1042 49
1043 53
1044 FF                 FCB    $FF
1045 00 AE              FDB    LIST
1047 4E                 FCC    'NOL'
1048 4F
1049 4C
104A 00                 FCB    0
104B 00 AE              FDB    LIST
104D 54                 FCC    'TAP'
104E 41
104F 50
1050 FF                 FCB    $FF
1051 00 B2              FDB    TAPE
1053 4E                 FCC    'NOT'
1054 4F
1055 54
1056 00                 FCB    0
1057 00 B2              FDB    TAPE
```

```
LOCN B1 B2 B3
1059 4D                    FCC     'MEM'
105A 45
105B 4D
105C FF                    FCB     $FF
105D 00 B3                 FDB     MEMORY
105F 4E                    FCC     'NOM'
1060 4F
1061 4D
1062 00                    FCB     0
1063 00 B3                 FDB     MEMORY
1065 53                    FCC     'SYM'
1066 59
1067 4D
1068 FF                    FCB     $FF
1069 00 AF                 FDB     SYMBOL
106B 4E                    FCC     'NOS'
106C 4F
106D 53
106E 00                    FCB     0
106F 00 AF                 FDB     SYMBOL
1071 47                    FCC     'GEN'
1072 45
1073 4E
1074 FF                    FCB     $FF
1075 00 B0                 FDB     GENER
1077 4E                    FCC     'NOG'
1078 4F
1079 47
107A 00                    FCB     0
107B 00 B0                 FDB     GENER
107D 50                    FCC     'PAG'
107E 41
107F 47
1080 FF                    FCB     $FF
1081 00 B1                 FDB     PAGER
1083 4E          OPNEND    FCC     'NOP'
1084 4F
1085 50
1086 00                    FCB     0
1087 00 B1                 FDB     PAGER
                 *
                 *
1089 7F 00 59    TYPE13    CLR     PCFLAG
108C 96 8F                 LDA A   PASS
108E 27 11                 BEQ     TYP13A
1090 96 4F                 LDA A   LABEL
1092 26 20                 BNE     TYP15A
1094 97 5E                 STA A   PRTFLG
1096 96 B1                 LDA A   PAGER      SEE IF PAGER ON
1098 27 07                 BEQ     TYP13A     IF NOT, IGNORE
109A 96 AE                 LDA A   LIST       SEE IF LIST ON
109C 27 03                 BEQ     TYP13A     IF NOT, IGNORE
109E 7F 00 5F              CLR     PAGFLG
10A1 39          TYP13A    RTS
                 *
```

```
LOCN B1 B2 B3
10A2 96 4F      TYPE14  LDA A  LABEL
10A4 26 0E              BNE    TYP15A
10A6 BD 11 D5           JSR    EVAL        GO EVALUATE OPERAND
10A9 DE 7B              LDX    QTEMP       GET RESULT
10AB DF 4B              STX    PC          SET PC
10AD DF 6D              STX    XTEMP2
10AF 39                 RTS
                *
10B0 96 4F      TYPE15  LDA A  LABEL
10B2 26 05              BNE    EQU1
10B4 86 07      TYP15A  LDA A  #7           SET ERROR
10B6 7E 07 E5           JMP    ASMERR
10B9 BD 09 05   EQU1    JSR    FNDLBL      FIND LABEL
10BC DF FD              STX    $FD
10BE 96 8F              LDA A  PASS        CHECK PASS
10C0 4A                 DEC A
10C1 97 56              STA A  ERRFLG
10C3 BD 11 D5           JSR    EVAL        GO EVALUATE
10C6 7F 00 56           CLR    ERRFLG
10C9 DE FD              LDX    $FD
10CB 96 7C              LDA A  QTEMP+1
10CD D6 7B              LDA B  QTEMP
10CF E7 06              STA B  6,X
10D1 A7 07              STA A  7,X
10D3 DE 7B              LDX    QTEMP
10D5 DF 6D              STX    XTEMP2
10D7 39         TYP15C  RTS
10D8 96 84              LDA A  LSTERR      ELSE ERROR
10DA 7E 07 E5           JMP    ASMERR      GO REPORT
                *
10DD 7F 00 59   TYPE16  CLR    PCFLAG
10E0 96 4F              LDA A  LABEL
10E2 26 D0              BNE    TYP15A
10E4 86 FF              LDA A  #$FF
10E6 97 58              STA A  ENDFLG
10E8 39                 RTS
                *
10E9 7F 00 59   TYPE17  CLR    PCFLAG
10EC 96 8F              LDA A  PASS
10EE 27 2E              BEQ    NAM3        IF PASS1 IGNORE
10F0 96 4F              LDA A  LABEL
10F2 26 C0              BNE    TYP15A
10F4 CE 00 C6           LDX    #TITLE
10F7 DF 65              STX    XSAVE       SAVE PTR
10F9 DE 96      NAM1    LDX    OPNPTR      GET POINTER
10FB A6 00              LDA A  0,X
10FD 81 0D              CMP A  #$D         CHECK FOR CR
10FF 27 0F              BEQ    NAM2
1101 08                 INX    GET TO NEXT
1102 DF 96              STX    OPNPTR
1104 DE 65              LDX    XSAVE       GET OTHER PTR
1106 A7 00              STA A  0,X
1108 08                 INX
1109 DF 65              STX    XSAVE       UPDATE
110B 8C 00 E6           CPX    #TITLE+32
```

```
LOCN B1 B2 B3
110E 26 E9          BNE     NAM1
1110 86 20    NAM2  LDA A   #$20
1112 DE 65          LDX     XSAVE
1114 8C 00 E6 FILTIT CPX    #TITLE+32
1117 27 05          BEQ     NAM3
1119 A7 00          STA A   0,X
111B 08             INX
111C 20 F6          BRA     FILTIT
111E 39       NAM3  RTS
              *
111F BD 11 D5 TYPE18 JSR    EVAL
1122 CE 00 7B       LDX     #QTEMP
1125 D6 4C          LDA B   PC+1
1127 96 4B          LDA A   PC
1129 BD 0C FA       JSR     ADD16
112C DE 7B          LDX     QTEMP
112E DF 4B          STX     PC
1130 39             RTS
              *
              ** EJECT
1131 37       EJECT PSH B
1132 D6 B1          LDA B   PAGER     SEE IF PAGE ON
1134 27 65          BEQ     NOEJT     IF NOT, SKIP
1136 CE 11 D1       LDX     #EJSTR    POINT TO EJECT STRING
1139 BD 07 AB       JSR     PDATA     PRINT THE CHARS
113C 37             PSH B
113D 4F             CLR A
113E 97 A8          STA A   LINCNT
1140 97 B1          STA A   PAGER     TURN PAGER OFF
1142 C6 03          LDA B   #3
1144 27 06          BEQ     MARDON
1146 BD 07 BA PRTMAR JSR    PCRLF
1149 5A             DEC B
114A 26 FA          BNE     PRTMAR    PRINT MARGIN
114C CE 00 C6 MARDON LDX    #TITLE
114F BD 07 AB       JSR     PDATA     SET IN TITLE
1152 CE 11 A9       LDX     #PPP
1155 BD 07 AB       JSR     PDATA     PRINT HEADER
1158 96 AD          LDA A   PAGENO+1
115A 8B 01          ADD A   #1        KICK PAGE COUNT
115C 19             DAA
115D 97 AD          STA A   PAGENO+1
115F 96 AC          LDA A   PAGENO
1161 89 00          ADC A   #0
1163 19             DAA
1164 97 AC          STA A   PAGENO
1166 27 0C          BEQ     PPAG2
1168 84 F0          AND A   #$F0
116A 27 03          BEQ     PPAG6
116C 8D 2F          BSR     OUTHL     PRINT MS
116E 5C             INC B             SET FLAG
116F 96 AC    PPAG6 LDA A   PAGENO     GET BYTE
1171 8D 30          BSR     OUTHR     PRINT LS OF MS
1173 5C             INC B
1174 96 AD    PPAG2 LDA A   PAGENO+1  GET LS BYTE
```

```
LOCN B1 B2 B3
1176 27 1E            BEQ    PPAG3
1178 5D               TST B                SEE IF PRINTED YET
1179 26 04            BNE    PPAG5         IF SO, JUST PRINT
117B 85 F0            BIT A  #$F0          CHECK MS DIGIT
117D 27 04            BEQ    PPAG4         IF 0, DON'T PRINT
117F 8D 1C      PPAG5 BSR    OUTHL         PRINT
1181 96 AD            LDA A  PAGENO+1
1183 8D 1E      PPAG4 BSR    OUTHR
1185 BD 07 BA         JSR    PCRLF
1188 BD 07 BA         JSR    PCRLF
118B 86 FF            LDA A  #$FF
118D 97 5C            STA A  EJFLG
118F 97 5F            STA A  PAGFLG
1191 33               PUL B                GET PAGE STATUS
1192 D7 B1            STA B  PAGER         RESTORE
1194 33               PUL B
1195 39               RTS                  DONE
1196 5D         PPAG3 TST B                CHECK IF PRINTED
1197 26 E6            BNE    PPAG5
1199 20 E8            BRA    PPAG4
119B 33         NOEJT PUL B
119C 39               RTS                  DONE
119D BD 0C DB   OUTHL JSR    HEXL
11A0 7E 03 20         JMP    OUTCH
11A3 BD 0C DF   OUTHR JSR    HEXR
11A6 7E 03 20         JMP    OUTCH
11A9 20         PPP   FCC    '            '
11AA 20
11AB 20
11AC 20
11AD 20
11AE 20
11AF 20
11B0 20                                PEB
11B1 54               FCC    'TSC MNEMONIC ASSEMBLER    PAGE '
11B2 53
11B3 43
11B4 20
11B5 4D
11B6 4E
11B7 45
11B8 4D
11B9 4F
11BA 4E
11BB 49
11BC 43
11BD 20
11BE 41
11BF 53
11C0 53
11C1 45
11C2 4D
11C3 42
11C4 4C
11C5 45
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LOCN B1 B2 B3
11C6 52
11C7 20
11C8 20
11C9 20
11CA 20
11CB 50
11CC 41
11CD 47
11CE 45
11CF 20
11D0 04                 FCB     4
11D1 00          EJSTR  FCB     0,0,$A,4
11D2 00
11D3 0A
11D4 04
                 *
                 ** EVAL
                 * EVALUATE AN OPERAND EXPRESSION
11D5 4F          EVAL   CLR A
11D6 97 7B              STA A   QTEMP
11D8 97 7C              STA A   QTEMP+1
11DA 97 63              STA A   OPN             INITIALIZE
11DC DE 6B              LDX     XTEMP1
11DE DF 96              STX     OPNPTR          SET POINTER
11E0 DE 96       EVAL1A LDX     OPNPTR          GET OPERAND PTR
11E2 A6 00       FINDSC LDA A   0,X             GET CHAR
11E4 08                 INX
11E5 5F                 CLR B
11E6 81 2B              CMP A   #'+
11E8 27 27              BEQ     F1
11EA 5C                 INC B
11EB 81 2D              CMP A   #'-
11ED 27 22              BEQ     F1
11EF 5C                 INC B
11F0 81 2A              CMP A   #'*
11F2 26 0A              BNE     FINDS4
11F4 09                 DEX
11F5 9C 96              CPX     OPNPTR
11F7 07                 TPA
11F8 08                 INX
11F9 06                 TAP
11FA 27 E6              BEQ     FINDSC
11FC 20 13              BRA     F1
11FE 5C          FINDS4 INC B
11FF 81 2F              CMP A   #'/
1201 27 0E              BEQ     F1
1203 C6 FF       F2     LDA B   #$FF
1205 81 20              CMP A   #'
1207 27 08              BEQ     F1
1209 81 2C              CMP A   #',
120B 27 04              BEQ     F1
120D 81 0D              CMP A   #$D
120F 26 D1              BNE     FINDSC
1211 D7 64       F1     STA B   TERM            SAVE TERMINATOR
1213 09                 DEX                     ADJUST
```

```
LOCN B1 B2 B3
1214 DF 6B          STX     XTEMP1
1216 DE 96     LOAD LDX     OPNPTR     GET POINTER
1218 7F 00 7D       CLR     TEMP
121B A6 00          LDA A   0,X        GET CHARACTER
121D 81 41          CMP A   #'A
121F 25 1F          BCS     LOAD1
1221 81 5A          CMP A   #'Z
1223 22 1B          BHI     LOAD1      CHECK FOR LABEL
1225 DF 79          STX     QTEMP2     SAVE X
1227 BD 0C 65       JSR     CLRLAB     SET LABEL TO ZERO
122A DE 79          LDX     QTEMP2     GET X BACK
122C BD 0C 8F       JSR     COPLBL
122F BD 09 05       JSR     FNDLBL     GO GET VALUE
1232 EE 06          LDX     6,X        GET VALUE
1234 DF 79          STX     QTEMP2     STORE IT
1236 DE 6B          LDX     XTEMP1
1238 4D             TST A              SEE IF FOUND
1239 2A 50          BPL     L5
123B 86 01          LDA A   #1
123D 7E 12 98       JMP     F3
1240 C6 01     LOAD1 LDA B  #1         SET ID
1242 81 24          CMP A   #'$        CHECK FOR BASE/TAGS
1244 27 2F          BEQ     L1
1246 5C             INC B
1247 81 25          CMP A   #$25       PERCENT
1249 27 2A          BEQ     L1
124B 5C             INC B
124C 81 40          CMP A   #'@
124E 27 25          BEQ     L1
1250 5C             INC B
1251 81 27          CMP A   #$27       CHECK FOR SINGLE QUOTE
1253 27 20          BEQ     L1
1255 DE 6B          LDX     XTEMP1     GET END POINTER
1257 09             DEX                MOVE TO LAST CHAR
1258 7C 00 7D       INC     TEMP
125B 5A             DEC B
125C A6 00          LDA A   0,X        GET IT
125E 81 4F          CMP A   #'O        CHECK OCTAL
1260 27 16          BEQ     L2
1262 81 51          CMP A   #'Q        CHECK OCTAL
1264 27 12          BEQ     L2
1266 5A             DEC B
1267 81 42          CMP A   #'B        CHECK BINARY
1269 27 0D          BEQ     L2
126B 5A             DEC B
126C 81 48          CMP A   #'H        CHECK HEX
126E 27 08          BEQ     L2
1270 5A             DEC B              SET DECIMAL
1271 D7 7D          STA B   TEMP
1273 20 03          BRA     L2
1275 08        L1   INX                MOVE TO FIRST CHAR OF CONST
1276 DF 96          STX     OPNPTR     SAVE
1278 4F        L2   CLR A
1279 97 79          STA A   QTEMP2
127B 97 7A          STA A   QTEMP2+1
```

```
LOCN B1 B2 B3
127D CE 12 C9          LDX     #BCONV     POINT TO TABLE
1280 58                ASL B
1281 27 04             BEQ     L4
1283 08          L3    INX
1284 5A                DEC B
1285 26 FC             BNE     L3         GET TO ADDRESS
1287 EE 00       L4    LDX     0,X        GET ADDRESS
1289 AD 00             JSR     0,X        COLLECT DATA
128B 96 7D       L5    LDA A   TEMP       CHECK PRE OR POST
128D 27 01             BEQ     L6
128F 08                INX
1290 DF 71       L6    STX     XTEMP4     SAVE
1292 9C 6B             CPX     XTEMP1     SEE IF GOT ALL
1294 27 0B             BEQ     EVAL1B
1296 86 09             LDA A   #9
1298 7F 00 7B    F3    CLR     QTEMP
129B 7F 00 7C          CLR     QTEMP+1    RESET ARG
129E 7E 07 E5          JMP     ASMERR     GO TO ERROR
12A1 96 63       EVAL1B LDA A  OPN        GET OPERATION
12A3 CE 12 C1          LDX     #OPNTBL    POINT TO JUMP TABLE
12A6 48                ASL A
12A7 27 04             BEQ     EVAL3
12A9 08          EVAL2 INX                POINT NEXT
12AA 4A                DEC A
12AB 26 FC             BNE     EVAL2      MOVE TO TARGET
12AD EE 00       EVAL3 LDX     0,X        GET TARGET ADDR.
12AF AD 00             JSR     0,X        DO OPERATION
12B1 DE 6B             LDX     XTEMP1     GET POINTER
12B3 08                INX
12B4 DF 96             STX     OPNPTR     SAVE PLACE
12B6 96 64             LDA A   TERM       GET LAST TERM
12B8 97 63             STA A   OPN        SAVE OPERATION
12BA 2B 03             BMI     EVAL4      IF A TERMINATOR, DONE
12BC 7E 11 E0          JMP     EVAL1A     ELSE PROCESS AGAIN
12BF 4F          EVAL4 CLR A                DONE
12C0 39                RTS
                 *
12C1 12 D3       OPNTBL FDB    OPADD
12C3 12 DD             FDB     OPSUB
12C5 12 E7             FDB     OPMUL
12C7 13 0F             FDB     OPDIV
                 *
12C9 13 5B       BCONV FDB     DECM
12CB 13 9A             FDB     HEX
12CD 13 BA             FDB     BIN
12CF 13 D0             FDB     OCT
12D1 13 E7             FDB     ASC
                 *
12D3 96 79       OPADD LDA A   QTEMP2
12D5 D6 7A             LDA B   QTEMP2+1   GET OPERAND
12D7 CE 00 7B          LDX     #QTEMP     POINT TO ACC.
12DA 7E 0C FA          JMP     ADD16      GO ADD
                 *
12DD 96 79       OPSUB LDA A   QTEMP2
12DF D6 7A             LDA B   QTEMP2+1
```

```
LOCN B1 B2 B3
12E1 CE 00 7B          LDX    #QTEMP
12E4 7E 0C E8          JMP    SUB16
                  *
12E7 CE 00 00  OPMUL   LDX    #0
12EA DF 77             STX    QTEMP3      SET ACCUM.
12EC CE 00 77          LDX    #QTEMP3
12EF C6 10             LDA B  #16         SET COUNT
12F1 A6 03     OPMUL2  LDA A  3,X
12F3 46                ROR A              CHECK BIT
12F4 24 09             BCC    OPMUL3
12F6 37                PSH B
12F7 A6 04             LDA A  4,X
12F9 E6 05             LDA B  5,X         GET OPERANDS
12FB BD 0C FA          JSR    ADD16       ADD IN
12FE 33                PUL B
12FF 64 00     OPMUL3  LSR    0,X
1301 66 01             ROR    1,X
1303 66 02             ROR    2,X
1305 66 03             ROR    3,X
1307 5A                DEC B              COUNT OFF
1308 26 E7             BNE    OPMUL2
130A EE 02             LDX    2,X         GET RESULT
130C DF 7B             STX    QTEMP       SAVE
130E 39                RTS
                  *
130F CE 00 00  OPDIV   LDX    #0
1312 DF 77             STX    QTEMP3      INIT. ACCUM.
1314 DE 79             LDX    QTEMP2
1316 D6 7C             LDA B  QTEMP+1
1318 D7 7A             STA B  QTEMP2+1
131A D6 7B             LDA B  QTEMP
131C D7 79             STA B  QTEMP2
131E DF 7B             STX    QTEMP       MOVE OPERAND
1320 C6 11             LDA B  #17         SET COUNT
1322 CE 00 77          LDX    #QTEMP3     POINT TO ACC.
1325 37        OPDIV1  PSH B
1326 96 7B             LDA A  QTEMP
1328 D6 7C             LDA B  QTEMP+1
132A BD 0C E8          JSR    SUB16
132D 25 08             BCS    OPDIV3
132F 96 7B             LDA A  QTEMP
1331 D6 7C             LDA B  QTEMP+1
1333 BD 0C FA          JSR    ADD16       ADD BACK
1336 0C                CLC
1337 69 03     OPDIV3  ROL    3,X
1339 69 02             ROL    2,X
133B 69 01             ROL    1,X
133D 69 00             ROL    0,X         SHIFT IT
133F 33                PUL B              RETRIEVE COUNT
1340 5A                DEC B              COUNT OFF
1341 26 E2             BNE    OPDIV1      DO AGAIN
1343 EE 02             LDX    2,X         GET RESULT
1345 DF 7B             STX    QTEMP       SAVE
1347 39                RTS                DONE
                  *
```

```
LOCN B1 B2 B3
                    *
1348 E6 00          INDEC   LDA B   0,X         GET A CHAR
134A C0 3A                  SUB B   #$3A        REMOVE BIAS
134C 24 02                  BCC     INDEC2
134E CB 0A                  ADD B   #$A         CORRECT
1350 39             INDEC2  RTS
                    *
1351 96 6D          SPCL    LDA A   XTEMP2
1353 97 79                  STA A   QTEMP2
1355 96 6E                  LDA A   XTEMP2+1
1357 97 7A                  STA A   QTEMP2+1
1359 08                     INX                 ALIGN POINTER
135A 39                     RTS
                    *
135B 8D 2B          DECM    BSR     INITR       GO INITIALIZE
135D A6 00                  LDA A   0,X
135F 81 2A                  CMP A   #'*         CHECK SPECIAL CHAR
1361 27 EE                  BEQ     SPCL
1363 8D E3          DECM2   BSR     INDEC       GO FETCH
1365 24 20                  BCC     DECM3
1367 37                     PSH B
1368 96 79                  LDA A   QTEMP2
136A D6 7A                  LDA B   QTEMP2+1
136C 8D 25                  BSR     LONE        LEFT ONE
136E 8D 23                  BSR     LONE        AGAIN
1370 DB 7A                  ADD B   QTEMP2+1
1372 D7 7A                  STA B   QTEMP2+1    ADD IN
1374 99 79                  ADC A   QTEMP2
1376 97 79                  STA A   QTEMP2
1378 8D 19                  BSR     LONE        LEFT AGAIN
137A 33                     PUL B
137B 4F                     CLR A
137C DB 7A                  ADD B   QTEMP2+1
137E 99 79                  ADC A   QTEMP2
1380 D7 7A                  STA B   QTEMP2+1
1382 97 79                  STA A   QTEMP2
1384 08                     INX
1385 20 DC                  BRA     DECM2       GO AT IT AGAIN
1387 39             DECM3   RTS
                    *
1388 DE 96          INITR   LDX     OPNPTR      GET POINTER
138A 7F 00 79               CLR     QTEMP2
138D 7F 00 7A               CLR     QTEMP2+1    ZERO ACCUMULATOR
1390 39                     RTS
                    *
1391 8D 00          LTWO    BSR     LONE        LEFT ONE
                    *
1393 78 00 7A       LONE    ASL     QTEMP2+1
1396 79 00 79               ROL     QTEMP2
1399 39                     RTS
                    *
139A 8D EC          HEX     BSR     INITR       INITIALIZE
139C A6 00          HEX2    LDA A   0,X         GET CHAR
139E 80 47                  SUB A   #'G         REMOVE BIAS
13A0 2A 17                  BPL     HEX4
```

```
LOCN B1 B2 B3
13A2 8B 06              ADD A  #6          ADD ON
13A4 2A 04              BPL    HEX3
13A6 8B 07              ADD A  #7          ADD AGAIN
13A8 2A 0F              BPL    HEX4        REMOVE $3A - $40
13AA 8B 0A       HEX3   ADD A  #10         CORRECT
13AC 2B 0B              BMI    HEX4        REMOVE <$30
13AE 8D E1              BSR    LTWO
13B0 8D DF              BSR    LTWO
13B2 9B 7A              ADD A  QTEMP2+1
13B4 97 7A              STA A  QTEMP2+1
13B6 08                 INX
13B7 20 E3              BRA    HEX2
13B9 39          HEX4   RTS
                 *
13BA 8D CC       BIN    BSR    INITR
13BC A6 00       BIN2   LDA A  0,X
13BE 80 30              SUB A  #$30
13C0 2B F7              BMI    HEX4
13C2 81 01              CMP A  #1
13C4 22 F3              BHI    HEX4
13C6 46                 ROR A
13C7 79 00 7A           ROL    QTEMP2+1
13CA 79 00 79           ROL    QTEMP2
13CD 08                 INX
13CE 20 EC              BRA    BIN2
                 *
13D0 8D B6       OCT    BSR    INITR
13D2 A6 00       OCT1   LDA A  0,X
13D4 80 30              SUB A  #$30
13D6 2B E1              BMI    HEX4
13D8 81 07              CMP A  #7
13DA 22 DD              BHI    HEX4
13DC 8D B3              BSR    LTWO
13DE 8D B3              BSR    LONE        MULT X 8
13E0 9B 7A              ADD A  QTEMP2+1
13E2 97 7A              STA A  QTEMP2+1
13E4 08                 INX
13E5 20 EB              BRA    OCT1
13E7 8D 9F       ASC    BSR    INITR       GO INITIALIZE
13E9 A6 00              LDA A  0,X         GET CHAR
13EB 97 7A              STA A  QTEMP2+1    SET CHAR
13ED DE 6B              LDX    XTEMP1      IGNORE REST
13EF 39                 RTS                DONE
                 *
                 *
                 ** SHELL
                 * DO A SHELL SORT
13F0 7F 00 7D    SHELL  CLR    TEMP
13F3 86 08              LDA A  #8
13F5 36                 PSH A
13F6 86 20              LDA A  #32
13F8 36                 PSH A
13F9 86 68              LDA A  #104
13FB 36                 PSH A              SET GAP WIDTHS
13FC 32          SHELL1 PUL A            GET A GAP
```

```
LOCN B1 B2 B3
13FD 97 AA          STA A  GAP        SAVE
13FF DE 40          LDX    LBLBEG
1401 DF 77    SHELL2 STX    QTEMP3     SAVE PLACE
1403 DF 7B    SETGAP STX    QTEMP      SAVE PTR
1405 96 7C          LDA A  QTEMP+1
1407 9B AA          ADD A  GAP
1409 97 7A          STA A  QTEMP2+1
140B 96 7B          LDA A  QTEMP
140D 89 00          ADC A  #0
140F 97 79          STA A  QTEMP2     SET BOTTOM POINTER
1411 91 42          CMP A  LBLEND
1413 25 08          BCS    SORT
1415 26 60          BNE    PASDON
1417 96 7A          LDA A  QTEMP2+1
1419 91 43          CMP A  LBLEND+1
141B 24 5A          BCC    PASDON
141D C6 06    SORT  LDA B  #6          SET FOR 6 COMPARES
141F DE 7B          LDX    QTEMP      GET TOP PTR
1421 DF 69          STX    XTEMP      SAVE
1423 DE 79          LDX    QTEMP2     GET BOTTOM PTR
1425 DF 6D          STX    XTEMP2     SAVE
1427 DE 69    CHKLOP LDX    XTEMP      GET PTR
1429 A6 00          LDA A  0,X
142B 08             INX               GET CHAR AND ADV.
142C DF 69          STX    XTEMP
142E DE 6D          LDX    XTEMP2     GET PTR
1430 A1 00          CMP A  0,X        CHECK RELATION
1432 27 4D          BEQ    SAME       SAME?
1434 23 30          BLS    ORDOK      IN ORDER?
1436 C6 08          LDA B  #8         SET 8 TRANSFERS
1438 DE 7B          LDX    QTEMP      GET TABLE PTR
143A DF 69    MOVELP STX    XTEMP      SAVE
143C 37             PSH B             SAVE COUNT
143D A6 00          LDA A  0,X
143F DE 79          LDX    QTEMP2     GET DEST PTR
1441 E6 00          LDA B  0,X
1443 A7 00          STA A  0,X        SWITCH
1445 08             INX
1446 DF 79          STX    QTEMP2     SAVE PTR
1448 DE 69          LDX    XTEMP      GET DEST PTR
144A E7 00          STA B  0,X        SWITCH
144C 08             INX
144D 33             PUL B
144E 5A             DEC B
144F 26 E9          BNE    MOVELP     LOOP TILL DONE
1451 96 7D          LDA A  TEMP       GET FLAG
1453 26 03          BNE    SHELL5
1455 73 00 7D       COM    TEMP       CHANGE FLAG
1458 DE 7B    SHELL5 LDX    QTEMP      GET PTR
145A 9C 40          CPX    LBLBEG     SEE IF AT TOP
145C 27 08          BEQ    ORDOK      IF SO, GO DOWN
145E C6 08          LDA B  #8
1460 09       DECXX DEX               MOVE BACK
1461 5A             DEC B
1462 26 FC          BNE    DECXX
```

```
LOCN B1 B2 B3
1464 20 9D          BRA    SETGAP
1466 96 7D    ORDOK LDA A  TEMP      GET FLAG
1468 27 03          BEQ    SHELL6    IF 0, FOWARD
146A 7F 00 7D       CLR    TEMP      SET FOWARD
146D DE 77    SHELL6 LDX   QTEMP3    GET LIST POINTER
146F C6 08          LDA B  #8        SET FOR NEXT
1471 08       OFFLOP INX
1472 5A             DEC B            MOVE PTR
1473 26 FC          BNE    OFFLOP
1475 20 8A          BRA    SHELL2
1477 96 AA    PASDON LDA A GAP       GET DISTANCE
1479 81 08          CMP A  #8
147B 27 03          BEQ    SRTDON    IF 8, DONE
147D 7E 13 FC       JMP    SHELL1
1480 39       SRTDON RTS
1481 08       SAME   INX
1482 DF 6D          STX    XTEMP2    SAVE PTR
1484 5A             DEC B            CHECKED ALL 6?
1485 26 A0          BNE    CHKLOP
1487 20 DD          BRA    ORDOK
                    *
                    *
                    ** OBJCOD
                    * PRODUCE MIKBUG RECORD FORMAT
1489 96 62    OBJCOD LDA A OBJINT    SEE IF FIRST CALL
148B 27 0C          BEQ    OBJC01    IF SO, SKIP
148D CE 04 C0       LDX    #TAPEON
1490 BD 04 B2       JSR    CONTRL    TURN TAPE ON
1493 BD 04 C8       JSR    DELAY     DELAY FOR STARTUP
1496 7F 00 62       CLR    OBJINT    RESET FLAG
1499 DE 6D    OBJC01 LDX   XTEMP2    GET PC (LAST TIME'S)
149B 9C 9E          CPX    LASTPC
149D 07             TPA
149E DE 4B          LDX    PC
14A0 DF 9E          STX    LASTPC    SET NEW LAST PC
14A2 06             TAP               RESTORE CCR
14A3 27 03          BEQ    OBJC04    SEE IF NEW ORG
14A5 BD 15 18       JSR    PRTREC    IF SO, PRINT LAST PART
14A8 96 90    OBJC04 LDA A OPCNT     GET BYTE COUNTER
14AA D6 A7    OBJC03 LDA B BUFCNT    GET BUFFER COUNT
14AC 26 04          BNE    OBJC05    IF NOT EMPTY, SKIP
14AE DE 6D          LDX    XTEMP2    GET PC
14B0 DF A0          STX    OBJADR    SET RECORD ADDRESS
14B2 DE 89    OBJC05 LDX   OBJPTR    GET DEST PTR
14B4 D6 7E          LDA B  OPCODE
14B6 E7 00          STA B  0,X
14B8 08             INX
14B9 7C 00 A7       INC    BUFCNT
14BC 4A             DEC A
14BD 27 13          BEQ    OBJC06
14BF D6 7F          LDA B  OP1
14C1 E7 00          STA B  0,X
14C3 08             INX
14C4 7C 00 A7       INC    BUFCNT
14C7 4A             DEC A
```

```
LOCN B1 B2 B3
14C8 27 08          BEQ    OBJC06
14CA D6 80          LDA B  OP2
14CC E7 00          STA B  0,X
14CE 08             INX
14CF 7C 00 A7       INC    BUFCNT     PUT DATA, SET COUNT
14D2 8D 20    OBJC06 BSR   CHKGEN     GO CHECK IF BUF. FULL
14D4 96 5A          LDA A  DATFLG     CHECK FCC,FCB,FDB
14D6 27 3F          BEQ    OBJDON     IF NOT, DONE
14D8 CE 02 00       LDX    #BYTSTK
14DB DF 71          STX    XTEMP4     SET DATA BUFFER POINTER
14DD DE 71    OBJC07 LDX   XTEMP4     GET DATA POINTER
14DF 9C 87          CPX    BYTPTR     SEE IF EMPTY
14E1 27 34          BEQ    OBJDON     IF SO, DONE
14E3 A6 00          LDA A  0,X        GET DATA
14E5 08             INX
14E6 DF 71          STX    XTEMP4     FIX PTR
14E8 DE 89          LDX    OBJPTR     GET PTR
14EA A7 00          STA A  0,X        PUT DATA
14EC 08             INX               ADVANCE
14ED 7C 00 A7       INC    BUFCNT     FIX COUNT
14F0 8D 02          BSR    CHKGEN     CHECK GENERATE TIME
14F2 20 E9          BRA    OBJC07     LOOP TILL EMPTY
14F4 DF 89    CHKGEN STX   OBJPTR     SAVE POINTER
14F6 96 A7          LDA A  BUFCNT     GET COUNT
14F8 81 0F          CMP A  #15
14FA 22 01          BHI    GENOBJ     IF >=16  TIME TO PUNCH
14FC 39             RTS
14FD 36       GENOBJ PSH A             SAVE COUNT
14FE 86 10          LDA A  #16        SET BYTE COUNT
1500 BD 15 1C       JSR    RECORD     GO PUNCH RECORD
1503 32             PUL A             GET COUNT
1504 CE 00 B4       LDX    #OBJBUF
1507 80 10          SUB A  #16        CALCULATE DATA LEFT
1509 97 A7          STA A  BUFCNT     UPDATE COUNT
150B 27 08    SHIFTL BEQ   SAVEPL     IF 0, HAVE PLACE
150D E6 10    MOVE   LDA B 16,X       GET DATA
150F E7 00          STA B  0,X
1511 08             INX               MOVE PTR
1512 4A             DEC A             KICK COUNT
1513 26 F8          BNE    MOVE       MOVE ALL DATA
1515 DF 89    SAVEPL STX   OBJPTR     SAVE BUFFER PTR
1517 39       OBJDON RTS              DONE
1518 96 A7    PRTREC LDA A BUFCNT     GET  COUNT
151A 27 FB          BEQ    OBJDON     IF 0, NOTHING TO PUNCH
151C 36       RECORD PSH A            SAVE COUNT
151D 7F 00 A7       CLR    BUFCNT     SET COUNT 0
1520 CE 00 B4       LDX    #OBJBUF
1523 DF 89          STX    OBJPTR     RESET POINTER
1525 8D 3D          BSR    HEADER     PUNCH HEADER
1527 32             PUL A
1528 36             PSH A             GET COUNT
1529 8B 03          ADD A  #3         SET BYTE COUNT
152B 8D 23          BSR    TAPBYT     PUNCH BYTE
152D 96 A0          LDA A  OBJADR     GET MS ADDRESS
152F BD 15 50       JSR    TAPBYT
```

```
LOCN B1 B2 B3
1532 96 A1          LDA A  OBJADR+1
1534 8D 1A          BSR    TAPBYT
1536 32             PUL A
1537 36             PSH A             GET COUNT AGAIN
1538 9B A1          ADD A  OBJADR+1
153A 97 A1          STA A  OBJADR+1
153C 96 A0          LDA A  OBJADR
153E 89 00          ADC A  #0
1540 97 A0          STA A  OBJADR     SET NEW ADDRESS
1542 33             PUL B             GET COUNT
1543 DE 89          LDX    OBJPTR
1545 A6 00    OBJLP LDA A  0,X        GET DATA
1547 8D 07          BSR    TAPBYT     PUNCH IT
1549 08             INX
154A 5A             DEC B             CHECK DONE
154B 26 F8          BNE    OBJLP
154D 96 61          LDA A  CKSUM      GET CHECKSUM
154F 43             COM A             CORRECT
                    *
                    ** TAPBYT
                    * PUNCH A BYTE AND CALC CHECKSUM
1550 36       TAPBYT PSH A            SAVE BYTE
1551 9B 61          ADD A  CKSUM      UPDATE CHECKSUM
1553 97 61          STA A  CKSUM
1555 32             PUL A
1556 36             PSH A             GET CHAR
1557 BD 0C DB       JSR    HEXL
155A BD 03 23       JSR    TAPOUT
155D 32             PUL A
155E BD 0C DF       JSR    HEXR
1561 7E 03 23       JMP    TAPOUT
                    *
1564 CE 15 6F HEADER LDX    #LNHDX
1567 C6 08          LDA B  #8
1569 7F 00 61       CLR    CKSUM      SET CHECKSUM
156C 7E 04 B6       JMP    PCTRL      GO PUNCH
156F 0D       LNHDX FCB    $D,$A,0,0,0,0
1570 0A
1571 00
1572 00
1573 00
1574 00
1575 53             FCC    'S1'
1576 31
                    *
                    *
                    *
      003B          CHSM   EQU    $3B
                    *
                    ** MEMCOD
                    * INSTALL OBJECT CODE IN MEMORY
1577 DE 6D    MEMCOD LDX    XTEMP2     GET PC
1579 9C 9C          CPX    LSTPCM     CHECK CONTIGUOUS CODE
157B 07             TPA
157C DE 4B          LDX    PC
```

```
LOCN B1 B2 B3
157E DF 9C              STX    LSTPCM
1580 06                 TAP                 RESTORE STATUS
1581 27 12              BEQ    MEM2         IF CONT., SKIP
1583 8D 50              BSR    MEMPU2
1585 CE 18 EF           LDX    #MEMBUF
1588 96 6D              LDA A  XTEMP2       GET PC
158A A7 02              STA A  2,X
158C 96 6E              LDA A  XTEMP2+1
158E A7 03              STA A  3,X          PUT IN MEMORY
1590 CE 18 F3  MEM1     LDX    #MEMBUF+4    GET POINTER
1593 DF 8B              STX    MEMPTR       SAVE PTR
1595 DE 8B     MEM2     LDX    MEMPTR       GET POINTER
1597 D6 90              LDA B  OPCNT        GET COUNT
1599 96 7E              LDA A  OPCODE
159B 8D 2D              BSR    MEMPUT
159D 5A                 DEC B
159E 27 0B              BEQ    MEM3
15A0 96 7F              LDA A  OP1
15A2 8D 26              BSR    MEMPUT
15A4 5A                 DEC B
15A5 27 04              BEQ    MEM3
15A7 96 80              LDA A  OP2
15A9 8D 1F              BSR    MEMPUT
15AB DF 8B     MEM3     STX    MEMPTR       SAVE PLACE
15AD 96 5A              LDA A  DATFLG       CHECK FCC,FCB,FDB
15AF 26 01              BNE    EXTDAT       IF SO, GO SERVICE
15B1 39        MEM4     RTS                 DONE
15B2 CE 02 00  EXTDAT   LDX    #BYTSTK
15B5 DF 71              STX    XTEMP4       SET BUFFER POINTER
15B7 DE 71     MEM5     LDX    XTEMP4       GET POINTER
15B9 9C 87              CPX    BYTPTR       CHECK EMPTY
15BB 27 F4              BEQ    MEM4         IF SO, DONE
15BD A6 00              LDA A  0,X
15BF 08                 INX
15C0 DF 71              STX    XTEMP4       ADVANCE PTR AND SAVE
15C2 DE 8B              LDX    MEMPTR       GET DEST PTR
15C4 8D 04              BSR    MEMPUT
15C6 DF 8B              STX    MEMPTR       SAVE PLACE
15C8 20 ED              BRA    MEM5         DO TILL DONE

15CA A7 00     MEMPUT   STA A  0,X          PUT CHARACTER
15CC 08                 INX                 BUMP THE POINTER
15CD 7C 00 9A           INC    MCOUNT
15D0 8C 19 6A           CPX    #MEMBUF+123
15D3 26 3F              BNE    MEMPU8
15D5 96 9A     MEMPU2   LDA A  MCOUNT       GET COUNT
15D7 27 3B              BEQ    MEMPU8
15D9 37                 PSH B               SAVE B REG
15DA CE 18 EF           LDX    #MEMBUF      SET POINTER
15DD 4A                 DEC A
15DE A7 01              STA A  1,X          PUT BYTE COUNT
15E0 16                 TAB                 SAVE IT
15E1 CB 04              ADD B  #4
15E3 A6 00              LDA A  0,X
15E5 BD 17 74           JSR    WRITE        WRITE TO DISC
```

```
LOCN B1 B2 B3
15E8 08                    INX
15E9 A6 00        MEMPU4   LDA A  0,X        GET CHAR
15EB BD 17 74              JSR    WRITE      WRITE TO DISC
15EE 9B 3B                 ADD A  CHSM       FIX CHECKSUM
15F0 97 3B                 STA A  CHSM
15F2 08                    INX               BUMP TO NEXT
15F3 5A                    DEC B
15F4 26 F3                 BNE    MEMPU4
15F6 D7 9A                 STA B  MCOUNT     CLEAR COUNT
15F8 96 3B                 LDA A  CHSM       GET CHECKSUM
15FA 43                    COM A
15FB BD 17 74              JSR    WRITE      OUTPUT IT
15FE CE 18 EF              LDX    #MEMBUF
1601 DF 8B                 STX    MEMPTR     FIX POINTER
1603 5F                    CLR B
1604 D7 3B                 STA B  CHSM
1606 86 77                 LDA A  #119
1608 AB 03                 ADD A  3,X        FIX ADDRESS
160A E9 02                 ADC B  2,X
160C E7 02                 STA B  2,X        SAVE IT
160E A7 03                 STA A  3,X
1610 33                    PUL B             RESTORE B REG
1611 CE 18 F3              LDX    #MEMBUF+4
1614 39           MEMPU8   RTS               RETURN
                  *
                  *
                  * THE FOLLOWING ARE THE DISC ENTRY
                  * AND I-O ROUTINES. ALL EQUATES AND
                  * JUMP TABLES ARE SHOWN HERE.
                  *
                  *


                  * EQUATES TO DISC
     1B70         BUFPNT   EQU    $1B70
     1C00         LPTBEG   EQU    $1C00
     1FFF         LPTEND   EQU    $1FFF
     72FC         IBFPNT   EQU    $72FC
     0000         XFC      EQU    $0
     0001         Q04W     EQU    1
     0002         QWRT     EQU    2
     0003         QWC      EQU    3
     0004         Q04R     EQU    4
     0005         QRED     EQU    5
     0006         QSRC     EQU    6


                           ORG    $0030

                  * TEMPORARY STORAGE

0030              XTEMP6   RMB    2
0032              BUFEND   RMB    2
0034              OBJFLG   RMB    1
0035              OBJONL   RMB    1
```

```
LOCN B1 B2 B3
0036            FLG     RMB     1
0037            END     RMB     1
0038            PRNFLG  RMB     1
0039            ANLFLG  RMB     1
003A            ANSFLG  RMB     1


                        ORG     $1615

1615 20 24              BRA     DASMB       GO START


                * JUMP TABLE

1617 7E 72 94   ZGCHAR  JMP     $7294
161A 7E 72 97   ZGNCHR  JMP     $7297
161D 7E 72 9A   ZANCHK  JMP     $729A
1620 7E 72 91   ZFLSPC  JMP     $7291
1623 7E 72 83   ZWARMS  JMP     $7283
1626 7E 72 A9   ZTYPDE  JMP     $72A9
1629 7E 77 86   DFM     JMP     $7786
162C 7E 77 83   CDFM    JMP     $7783
162F 7E E1 AC   INCH    JMP     $E1AC
1632 7E E1 D1   POUCH   JMP     $E1D1
1635 7E E1 D1   PRNINT  JMP     $E1D1
1638 7E E1 D1   COUCH   JMP     $E1D1


                * MAIN LOOP HERE

163B CE 19 AF   DASMB   LDX     #BUFBEG
163E DF 44              STX     SRCBEG
1640 CE 1C 00           LDX     #LPTBEG
1643 DF 40              STX     LBLBEG
1645 DF 32              STX     BUFEND
1647 7A 00 32           DEC     BUFEND      ADJUST
164A CE 1F FF           LDX     #LPTEND
164D DF 42              STX     LBLEND
164F 4F                 CLR A               CLEAR FLAGS
1650 97 34              STA A   OBJFLG
1652 97 35              STA A   OBJONL
1654 97 38              STA A   PRNFLG
1656 97 39              STA A   ANLFLG
1658 97 3A              STA A   ANSFLG
165A 97 37              STA A   END
165C 86 00              LDA A   #0
165E 97 48              STA A   LINBYT
1660 BD 16 17           JSR     ZGCHAR      GET CHAR
1663 81 0D              CMP A   #$D
1665 27 0B              BEQ     DASMB2
1667 CE 17 A3           LDX     #RFCB       POINT TO BLOCK
166A BD 16 20           JSR     ZFLSPC      GET NAME
166D 24 09              BCC     DASMB3
166F BD 16 26   DASMB1  JSR     ZTYPDE      REPORT ERROR
1672 BD 16 2C   DASMB2  JSR     CDFM        CLOSE FILES
```

```
LOCN B1 B2 B3
1675 7E 16 23          JMP    ZWARMS    RETURN
1678 BD 17 2D DASMB3   JSR    OPEN      OPEN FILE
167B FE 72 FC          LDX    IBFPNT
167E A6 00             LDA A  0,X
1680 81 0D             CMP A  #$D
1682 27 57             BEQ    DASMB6
1684 08                INX               BUMP POINTER
1685 A6 00             LDA A  0,X        GET A CHAR.
1687 BD 16 1D          JSR    ZANCHK     CHECK IT
168A 24 05             BCC    DASMB4
168C FF 72 FC          STX    IBFPNT     SAVE POINTER
168F 20 1A             BRA    DASMB5
1691 CE 18 49 DASMB4   LDX    #WFCB      POINT TO BLOCK
1694 BD 16 20          JSR    ZFLSPC     GET NAME
1697 25 D6             BCS    DASMB1     ERROR?
1699 CE 18 49          LDX    #WFCB      POINT TO BLOCK
169C 86 01             LDA A  #QO4W
169E A7 00             STA A  XFC,X      OPEN FILE
16A0 97 34             STA A  OBJFLG
16A2 BD 16 29          JSR    DFM        CALL DFM
16A5 26 C8             BNE    DASMB1
16A7 86 02             LDA A  #QWRT
16A9 A7 00             STA A  XFC,X      SET FOR WRITE
16AB BD 16 17 DASMB5   JSR    ZGCHAR
16AE 81 0D             CMP A  #$D
16B0 27 29             BEQ    DASMB6
16B2 8D 67             BSR    GETIT      GET NEXT
16B4 27 25             BEQ    DASMB6
16B6 81 50             CMP A  #'P        IS IT PRINTER?
16B8 26 09             BNE    DASM53
16BA 97 38             STA A  PRNFLG     SET FLAG
16BC BD 16 35          JSR    PRNINT     INITIALIZE PRINTER
16BF 8D 5A             BSR    GETIT
16C1 27 18             BEQ    DASMB6
16C3 8D 56     DASM53  BSR    GETIT      GET NEXT
16C5 27 14             BEQ    DASMB6
16C7 81 4E             CMP A  #'N        NO LIST?
16C9 26 06             BNE    DASM55
16CB 97 39             STA A  ANLFLG     SET FLAG
16CD 8D 4C             BSR    GETIT
16CF 27 0A             BEQ    DASMB6
16D1 8D 48     DASM55  BSR    GETIT      GET NEXT
16D3 27 06             BEQ    DASMB6
16D5 81 4E             CMP A  #'N        IS IT NO SYMB?
16D7 26 02             BNE    DASMB6
16D9 97 3A             STA A  ANSFLG
16DB BD 03 26 DASMB6   JSR    P1INIT     PASS1 INITLZ
16DE BD 17 44 DASM65   JSR    FILBUF     GET TEXT
16E1 BD 03 B1          JSR    PASONE     DO PASS ONE
16E4 96 37             LDA A  END        FINISHED?
16E6 27 F6             BEQ    DASM65
16E8 7F 00 37          CLR    END
16EB 8D 34             BSR    REOPEN     OPEN FILE
16ED BD 03 6F          JSR    P2INIT     PASS 2 INITLZ
16F0 5F                CLR B
```

```
LOCN B1 B2 B3
16F1 D7 3B          STA B  CHSM
16F3 D7 9A          STA B  MCOUNT
16F5 86 42          LDA A  #'B          SET UP B
16F7 B7 18 EF       STA A  MEMBUF
16FA CE 18 F3       LDX    #MEMBUF+4
16FD DF 8B          STX    MEMPTR       SET POINTER
16FF 96 34          LDA A  OBJFLG
1701 97 B3          STA A  MEMORY       SET MEM FLAG
1703 96 39          LDA A  ANLFLG       TEST
1705 27 02          BEQ    DASM66
1707 D7 AE          STA B  LIST         CLEAR LIST
1709 96 3A    DASM66 LDA A  ANSFLG
170B 27 02          BEQ    DASMB7
170D D7 AF          STA B  SYMBOL       CLEAR SYMBS
170F 8D 33    DASMB7 BSR    FILBUF
1711 BD 03 D9       JSR    PASTWO       DO PASS 2
1714 96 37          LDA A  END          FINISHED?
1716 27 F7          BEQ    DASMB7
1718 7E 16 72       JMP    DASMB2

                    * GET AND TEST NEXT CHARACTER

171B BD 16 1A GETIT JSR    ZGNCHR       GET NEXT
171E 81 0D          CMP A  #$D          IS IT C.R.?
1720 39             RTS

                    * REOPEN READ FILE

1721 86 06    REOPEN LDA A  #QSRC       CLOSE FIRST
1723 CE 17 A3       LDX    #RFCB
1726 A7 00          STA A  XFC,X
1728 BD 16 29       JSR    DFM          CALL DFM
172B 26 11          BNE    OPEN2        ERROR?
172D 86 04    OPEN  LDA A  #QO4R        OPEN IT
172F CE 17 A3       LDX    #RFCB        POINT TO BLOCK
1732 A7 00          STA A  XFC,X
1734 BD 16 29       JSR    DFM
1737 26 05          BNE    OPEN2        ERROR?
1739 86 05          LDA A  #QRED        SET TO READ
173B A7 00          STA A  XFC,X
173D 39             RTS                 RETURN
173E BD 16 26 OPEN2 JSR    ZTYPDE       REPORT ERROR
1741 7E 16 72       JMP    DASMB2

                    * FILL BUFFER WITH SOURCE

1744 7F 00 36 FILBUF CLR   FLG          CLEAR FLAGS
1747 DE 44          LDX    SRCBEG       POINT TO AREA
1749 8D 39    FILBU1 BSR    READ         GET CHAR.
174B 9C 32          CPX    BUFEND
174D 26 03          BNE    FILBU2
174F 7C 00 36       INC    FLG          SET END MARK
```

```
LOCN B1 B2 B3
1752 81 0D      FILBU2  CMP A  #$D        IS IT C.R.?
1754 27 14              BEQ    FILBU5
1756 81 1A              CMP A  #$1A       IS IT TERM?
1758 26 0B              BNE    FILBU3
175A 97 37              STA A  END        SET FLAG
175C 09         FILB25  DEX               LOOK FOR CR
175D A6 00              LDA A  0,X        GET CHAR
175F 81 0D              CMP A  #$D
1761 26 F9              BNE    FILB25
1763 20 0C              BRA    FILBU6     GO FINISH
1765 A7 00      FILBU3  STA A  0,X        PUT THE CHAR
1767 08         FILBU4  INX               BUMP THE POINTER
1768 20 DF              BRA    FILBU1     REPEAT
176A A7 00      FILBU5  STA A  0,X
176C 7D 00 36           TST    FLG        FINISHED?
176F 27 F6              BEQ    FILBU4
1771 DF 46      FILBU6  STX    SRCEND     SAVE END
1773 39                 RTS               RETURN

                * WRITE TO DISC

1774 DF 30      WRITE   STX    XTEMP6     SAVE X
1776 CE 18 49           LDX    #WFCB      POINT TO BLOCK
1779 BD 16 29           JSR    DFM
177C 26 03              BNE    WRITE2     ERROR?
177E DE 30      WRITE1  LDX    XTEMP6     RESTORE X
1780 39                 RTS               RETURN
1781 7E 17 3E   WRITE2  JMP    OPEN2

                * READ FROM DISC

1784 DF 30      READ    STX    XTEMP6     SAVE X
1786 CE 17 A3           LDX    #RFCB      POINT TO BLOCK
1789 BD 16 29           JSR    DFM
178C 27 F0              BEQ    WRITE1     ERROR?
178E A6 01              LDA A  1,X        CHECK ERROR
1790 81 06              CMP A  #6
1792 26 ED              BNE    WRITE2
1794 86 1A              LDA A  #$1A       SET TERM
1796 20 E6              BRA    WRITE1     RETURN

                * OUTPUT

1798 7D 00 38   DASOUC  TST    PRNFLG     PRINTER?
179B 26 03              BNE    DASOU2
179D 7E 16 38           JMP    COUCH
17A0 7E 16 32   DASOU2  JMP    POUCH      PRINTER

                * FILE CONTROL BLOCKS

17A3            RFCB    RMB    166
```

```
LOCN B1 B2 B3
1849            WFCB    RMB     166
18EF            MEMBUF  RMB     128


                *
                * SPACE HERE FOR PRINTER ROUTINES
                *
196F                    RMB     64
                *
      19AF      BUFBEG  EQU     *           SOURCE BEGINNING

                *
                *
                        END
```

SYMBOL TABLE:

ADDPC0	0C88	ADDPC1	0C86	ADDPC2	0C7E	ADDPC3	0C72	ADD16	0CFA
ADVPTR	03A6	ANLFLG	0039	ANSFLG	003A	ASC	13E7	ASMERR	07E5
ASME2	0821	ASME3	0824	ASME4	082B	ASME5	0832	BCONV	12C9
BIN	13BA	BINGO	0962	BIN2	13BC	BUFBEG	19AF	BUFCNT	00A7
BUFEND	0032	BUFPNT	1B70	BYTCNT	00A6	BYTPTR	0087	BYTSTK	0200
CDFM	162C	CERR	047A	CHKCOM	0BAA	CHKERR	0437	CHKFRE	08A4
CHKGEN	14F4	CHKLBL	08DE	CHKLOP	1427	CHKTAP	04ED	CHK1	0939
CHK2	045D	CHK2ER	0433	CHK3	0464	CHSM	003B	CKDONE	0904
CKSUM	0061	CLRLAB	0C65	CLRLBL	0351	CNXT	0496	CONDON	04BF
CONT	05A5	CONTRL	04B2	COPDON	0CA8	COPLBL	0C8F	COUCH	1638
CRLF	07CF	DASMB	163B	DASMB1	166F	DASMB2	1672	DASMB3	1678
DASMB4	1691	DASMB5	16AB	DASMB6	16DB	DASMB7	170F	DASM53	16C3
DASM55	16D1	DASM65	16DE	DASM66	1709	DASOUC	1798	DASOU2	17A0
DATFLG	005A	DECM	135B	DECM2	1363	DECM3	1387	DECX	04CF
DECXX	1460	DELAY	04C8	DELDON	04D5	DFM	1629	DIRECT	0E04
EJCHR	000A	EJECT	1131	EJFLG	005C	EJSTR	11D1	END	0037
ENDFLG	0058	EQU1	10B9	ERRCNT	00A5	ERRFLG	0056	ERRHD	054B
ERRORS	00A9	ERRPTR	0085	ERRSTK	0100	EVAL	11D5	EVAL1A	11E0
EVAL1B	12A1	EVAL2	12A9	EVAL3	12AD	EVAL4	12BF	EXTDAT	15B2
EXTEND	0D3C	EXTEN0	0D43	EXTEN1	0D49	FCCFLG	005B	FERROR	091A
FILBUF	1744	FILBU1	1749	FILBU2	1752	FILBU3	1765	FILBU4	1767
FILBU5	176A	FILBU6	1771	FILB25	175C	FILTIT	1114	FIN	04D6
FINDCR	0C26	FINDSC	11E2	FINDSP	0C4F	FINDS2	0C50	FINDS4	11FE
FIN2	0505	FIN3	051E	FIN4	052F	FIN5	0516	FIN6	0537
FIX	0CC1	FIXMOD	0D5C	FIXM3	0D67	FIXM4	0D62	FIXM5	0D6D
FIXXX	0E84	FIXXX2	0E01	FLG	0036	FNDEND	102D	FNDLBL	0905
FNDOPT	091F	FND10	0908	FND222	0C44	F1	1211	F2	1203
F3	1298	GAP	00AA	GAPX	0531	GENER	00B0	GENOBJ	14FD
GETCHR	0CAC	GETERR	044D	GETER2	046B	GETIT	171B	GETSYM	057A
GOTLBL	091D	GOTMSG	0664	HASH	0867	HASHCT	00A4	HEADER	1564
HERROR	08B8	HEX	139A	HEXL	0CDB	HEXR	0CDF	HEX2	139C
HEX3	13AA	HEX4	13B9	IBFPNT	72FC	IMMED	0E3F	IMMED0	0E47
IMMED1	0E4E	IMMED2	0E67	IMMED3	0E6E	IMMED4	0E69	IMMED5	0E76

IMMED6	0E73	INCH	162F	INDEC	1348	INDEC2	1350	INDEX	0DA3
INDEX0	0DF3	INDEX1	0DBA	INDEX2	0DCB	INDEX3	0DD6	INDEX4	0DE0
INDEX5	0DFA	INDEX9	0DF9	INDE00	0DE7	INITR	1388	LABEL	004F
LABERR	0BBC	LABOUT	0584	LASTM	00A2	LASTPC	009E	LBLBEG	0040
LBLEND	0042	LBLMSK	0060	LINBYT	0048	LINCNT	00A8	LINES	0036
LINPTR	008D	LIST	00AE	LNHDX	156F	LOAD	1216	LOAD1	1240
LONE	1393	LOOP	084F	LPTBEG	1C00	LPTEND	1FFF	LSTERR	0084
LSTPCM	009C	LSTREC	04F1	LSTSYM	0575	LTEMP	0075	LTWO	1391
L1	1275	L2	1278	L3	1283	L4	1287	L5	128B
L6	1290	MAIN	0300	MARDON	114C	MATCH1	0952	MATFLG	0057
MCOUNT	009A	MEMBUF	18EF	MEMCOD	1577	MEMGEN	0414	MEMOBJ	0049
MEMORY	00B3	MEMPTR	008B	MEMPUT	15CA	MEMPU2	15D5	MEMPU4	15E9
MEMPU8	1614	MEM1	1590	MEM2	1595	MEM3	15AB	MEM4	15B1
MEM5	15B7	MESG0	0687	MESG1	069D	MESG10	0778	MESG11	078E
MESG2	06AE	MESG3	06C6	MESG4	06DE	MESG5	06F9	MESG6	0716
MESG7	072F	MESG8	073C	MESG9	0753	MIX2	0882	MIX3	089F
MODFY	00AB	MON	031B	MOVE	150D	MOVELP	143A	MOVPTR	05AD
MSGHD	0681	MSGTBL	0669	NAM1	10F9	NAM2	1110	NAM3	111E
NDIR	0E38	NOEJT	119B	NOERHD	0549	NOERR	0475	NOERR2	049D
NOERR4	04A4	NOLAB	03A4	NOMATL	0942	NOPRT	05AA	NXTBLK	0C5B
NXTBL2	0C5C	NXTBL3	0C64	OBJADR	00A0	OBJBUF	00B4	OBJCOD	1489
OBJC01	1499	OBJC03	14AA	OBJC04	14A8	OBJC05	14B2	OBJC06	14D2
OBJC07	14DD	OBJDON	1517	OBJFLG	0034	OBJGEN	040D	OBJINT	0062
OBJLP	1545	OBJONL	0035	OBJPTR	0089	OCT	13D0	OCT1	13D2
OFFLOP	1471	OPADD	12D3	OPCNT	0090	OPCODE	007E	OPDIV	130F
OPDIV1	1325	OPDIV3	1337	OPEN	172D	OPEN2	173E	OPMUL	12E7
OPMUL2	12F1	OPMUL3	12FF	OPN	0063	OPNEND	1083	OPNPTR	0096
OPNTBL	12C1	OPSERR	07D6	OPSUB	12DD	OPTABL	096B	OPTDON	1040
OPTEND	0B6F	OPTERR	094D	OPTLST	1041	OPTPTR	0094	OP1	007F
OP2	0080	ORDOK	1466	OUTCH	0320	OUTHEX	0CD0	OUTHL	119D
OUTHR	11A3	OUTHXS	0CCC	OUTS	031E	OUTSZ	0CC9	OUT2S	0CC7
OUT3S	0CC5	PAGENO	00AC	PAGER	00B1	PAGFLG	005F	PARFF2	0C4B
PARSE	0B75	PARSE0	0B7F	PARSE1	0BAE	PARSE2	0BD4	PARSE3	0C2D
PARSE4	0C39	PARSE5	0C38	PARSE6	0C36	PARSE7	0C33	PARS0A	0B77
PARS1A	0BC3	PARS1B	0BD1	PARS2A	0C04	PARS2B	0C10	PARS2D	0C11
PARS2E	0C24	PARS2F	0BFF	PARS2H	0C3C	PARS2J	0C1D	PASDON	1477
PASONE	03B1	PASS	008F	PASS1	03B9	PASS11	03C7	PASS12	03CE
PASS13	03D8	PASS2	03E0	PASS2A	03E8	PASS2B	03FA	PASS2C	041B
PASS2X	0401	PASTHR	05BB	PASTWO	03D9	PC	004B	PCFLAG	0059
PCRLF	07BA	PCRLF1	07C8	PCRLF2	07CC	PCTRL	04B6	PDATA	07AB
PEVAL	0BF2	PLOOP	07A7	POUCH	1632	PPAG2	1174	PPAG3	1196
PPAG4	1183	PPAG5	117F	PPAG6	116F	PPP	11A9	PRFLG	0055
PRNFLG	0038	PRNINT	1635	PRTDAT	05FF	PRTERR	0651	PRTFLG	005E
PRTINA	05CF	PRTINB	05D5	PRTINC	05D7	PRTIND	05CE	PRTINE	05D3
PRTINF	05C1	PRTING	05F8	PRTIT	0CD8	PRTMAR	1146	PRTMES	04EA
PRTPC	0611	PRTREC	1518	PRTSRC	0642	PRTS1	0644	PRTS2	0650
PRT1	0636	PRT2	0639	PRT2ER	048F	PRT3	063C	PRT4	063F
PSTR	07B2	PTNXT	0660	PUTIT	08BB	PUTLBL	08A2	P1INIT	0326
P2DON	04B1	P2ERR1	0081	P2ERR2	0082	P2ERR3	0083	P2INIT	036F
P2IN3	03B0	P3FLG	005D	P3INIT	036F	QO4R	0004	QO4W	0001
QRED	0005	QSRC	0006	QTEMP	007B	QTEMP2	0079	QTEMP3	0077
QWC	0003	QWRT	0002	RANDOM	084B	READ	1784	RECORD	151C
REHASH	087F	REOPEN	1721	RFCB	17A3	RNDM	0091	SAME	1481
SAVEPL	1515	SAVPTR	0098	SETBIT	039C	SETGAP	1403	SETTL	035D
SET0	0512	SHELL	13F0	SHELL1	13FC	SHELL2	1401	SHELL5	1458
SHELL6	146D	SHIFTL	150B	SHORT	0422	SORT	141D	SPCL	1351
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TYP11A	0FD9	TYP11B	0FE3	TYP11C	0FE9	TYP12A	1005	TYP12B	1019		
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TYP3R	0D4C	WFCB	1849	WRITE	1774	WRITE1	177E	WRITE2	1781		
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XTEMP2	006D	XTEMP3	006F	XTEMP4	0071	XTEMP5	0073	XTEMP6	0030		
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